McGraw-Hill
Publishing Company, Inc.
James H. McGraw, *President*
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American Machinist

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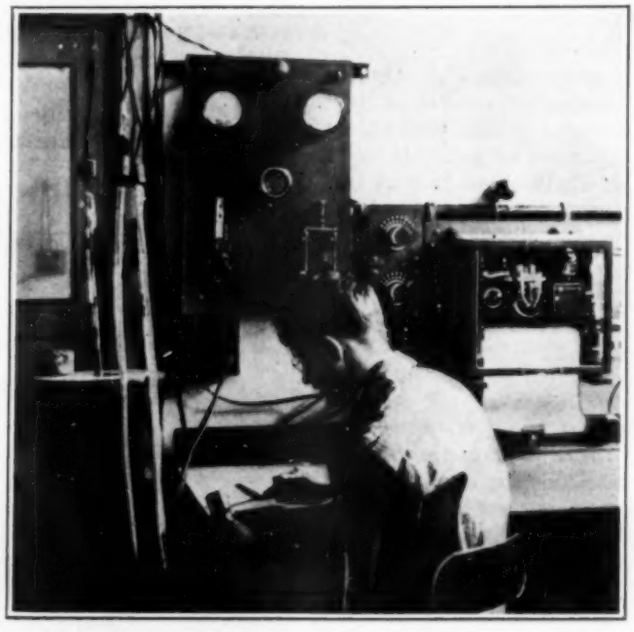
Volume 68 | New York, March 15, 1928 | Number 11

Freeing Production from Traditional Handicaps

Technical research and laboratory control of critical processes will relieve production from many of the mishaps that have heretofore been accepted as unavoidable

"A PREDECESSOR of the International Silver Company introduced silver smithing into the United States. Ever since that time those of us who have given our whole lives to manufacturing silver articles have been dogged by a series of production difficulties. By reason of our experiences we felt we knew about all there was to know about the few metals with which we had to work and we came to look upon those troubles as unavoidable handicaps that must be taken as part of the day's work. Since the establishment of our research laboratory, however, we have been forced to admit that there were many things we did not know because many of our old difficulties have been done away with by careful laboratory control of our production operations." This statement from the works manager of one of the International Silver factories is one of the finest tributes ever paid to technical research. It is illustrative of what may be done in any industry to eliminate the handicaps of methods dictated by rule-of-thumb and tradition. Although the new research laboratory at Meriden has only been in existence two or three years the men connected with it have made a start in working out ways of getting around many of the troubles that have plagued the production men, and some of the ways, at least, have been successful. A part of the work in the laboratory can be classed as research but the greater proportion of it has been in the development of accurate technical control of the processes in which variations have caused disaster.



All of the pyrometers in use in the various plants are tested in the laboratory at stated intervals. The ones that are subjected to most severe conditions are watched more carefully and are, of course, tested more frequently

The chemist and the physicist divide the laboratory work between them, but where one ends and the other begins it is difficult to say. As in most other metal working activities today the silver smithing industry is turning more and more frequently to the chemist for aid in perfecting the technical control of all sorts of operations.

Excellence of finish is one of the prime requisites in the manufacture of a piece of sterling or plated silver. Tarnish is its deadly enemy and is caused by hydrogen sulphide in the air which combines to form silver sulphide. Finished goods in stock are subject to more or less rapid deterioration depending on the amount of hydrogen sulphide present as well as upon the wrappings used. Tarnish, of course, yields readily enough to silver polish and elbow grease but the necessity of removing it adds an extra operation to the manufacturing cost and is therefore to be avoided. Lacquer is useful only for ornamental pieces not subjected to the three-times-daily washing that is the lot of flat wear. In sterling silver substitution of cadmium or zinc for the copper that usually forms the 7.5 per cent that is not pure silver may retard the formation of silver sulphide somewhat but does not eliminate it. Common sense indicated that since the silver could not be immunized something would have to be done about the sulphur. Research along this line developed the fact that no more than 0.0008 per cent active sulphur in the wrap-

ping paper, velvet linings for display boxes or the box material itself was needed to cause tarnish in time.

An entirely different problem was presented by the cracking under annealing of the nickel silver shells used as the base metal for plated hollow wear. Nickel silver, by the way, used to be called German silver, although why it should have been is hard to say because the alloy so named was used by the Chinese thousands of years ago. It is usually composed of 62 per cent copper, 18 per cent nickel and 20 per cent zinc.

To relieve the strains set up by deep drawing, these nickel shells are annealed. For no apparent reason an epidemic of cracking during the anneal used to break out periodically. It would be reasonable to expect a piece to crack during the draw if the amount of cold working had been excessive, but why should it wait until it was being annealed before it did so?

Careful tests showed that in the early stages of the anneal, between 500 and 600 deg. F., the metal hardened, thus intensifying the drawing strains. It was at this point that the cracking took place. If the piece passed the 600-

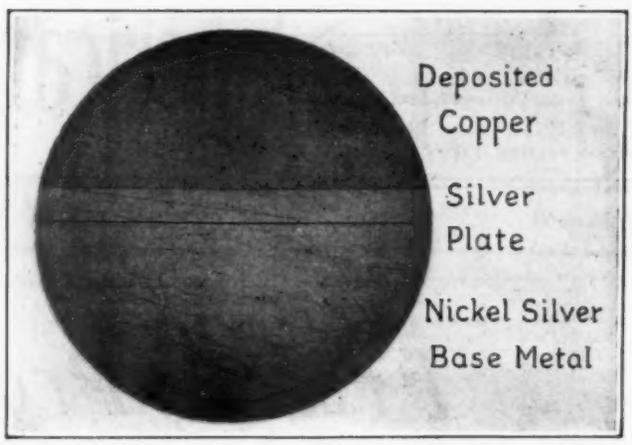
The chemical laboratory is used both for research and routine testing work. It is a valuable aid to the purchasing department

deg. mark, the subsequent softening relieved all strains.

The remedy was found in a careful control of the purity of the constituent metals and in the amount of drawing between each anneal. Further refinements were introduced in the melting room where about half of the alloy used by the company is prepared. Every melt is now analyzed for copper and nickel, the zinc being calculated by difference. The nickel content is usually held to a minimum of 18 per cent and seldom exceeds 18.5 per cent. Twenty-five heats are run daily and sample drillings are taken from each heat. Samples given to the laboratory in the morning are reported on the same evening as a matter of daily routine.

At present, further annealing research is being conducted through comparison of the regular factory anneal with an ideal laboratory anneal. Studies in the laboratory have shown that the time and temperature factors in annealing can be varied to advantage in accordance with the use to which the metal is to be put.

In addition to studies of the materials used in the product the laboratory force has also done a lot of work on the materials used in the processes, die steels, for instance, and plating solutions—if a solution can be considered as a process material. A separate article will be devoted to the die steel problem because of its importance.



Micro-photograph of a silver plated object, copper having been deposited above the silver, from which the thickness of the silver plate can be measured

It will be enough to say here that experiments have shown the value of adding chromium plate to hot forging dies. The life of such dies is increased about one half. Chromium-plated striking dies, however, are, so far, little better than unplated ones. Further experiments are in progress to see whether the acid brittleness caused by the chromium bath has any effect upon the life of the die and if it eventually can be eliminated by heating to normal drawing temperatures.

Research has done much to free production in the International Silver plants from traditional handicaps, but laboratory control of the factory processes has probably done even more. Electro-plating of silver is not a new art by any means, yet there has been little change in method since the first book on the subject was published. The process has been speeded up a bit but it is still complicated by variable factors hard to control.

Among the variable factors are the condition of the air, the quality of the silver anodes and the composition and temperature of the solution. These and other factors are being studied for the purpose of controlling as closely as possible the quality of the silver plate and its weight. It must be remembered that the International Silver Company guarantees the weight of silver deposited. If less than the guaranteed weight of silver results from the plating process the situation is embarrassing; if more, it is uneconomical.

The plating process is controlled by a meter which

A corner of the metallurgical laboratory showing the cylindrical electric furnace used for testing thermocouples

The electrolysis room of the chemical laboratory. The instruments shown are used for routine testing

rings a bell to indicate the end of the plating period. Each of these meters is under the control of the laboratory and is checked constantly.

Similar supervision is exercised over the solutions used. A sample of each solution is taken by a laboratory man periodically and analyzed in the chemical division.

All pyrometers used in all of the various plants are made up in the laboratory. Those used in the stainless steel hardening furnaces are checked every 14 days. They operate at 1,850 deg. F. The ones used in the annealing furnaces, which are not heated above 1,450 deg. F., are checked less frequently due to the lower operating temperature.

Another type of control in which the laboratory functions to advantage is in the purchase of materials. In this work there is the closest co-operation between the laboratory and the purchasing department to the end that the company may be sure it is getting what it wants, and at a fair price.

Silver cyanide for the plating solutions is bought by the purchasing agent to a specification. Before acceptance each lot must be checked in the chemical laboratory against the specification.

Oils are bought in the same way. The laboratory checks them for specific gravity, viscosity, acid content, cold point and flash point.

Tripoli, the abrasive used on the cotton polishing wheels, should preferably be mixed with a saponifiable grease. If there is too little grease the abrasive is thrown off by the wheel. If there is too much it sticks to the work, which is very undesirable. Here again the quality is checked by the laboratory.

Lacquer for use on ornamental hollow ware presents much the same sort of problem. If it contains too much gum it gives a yellowish tinge to the article. If it is whitened by removing gum it is likely to come off of sharp corners. A close check on quality is desirable.

An even closer co-operation between the two departments is needed when steel purchases are under consideration but discussion of that situation will be left to a subsequent article.

"It is better social cost-keeping to add the overhead burden of unemployment to those goods which are responsible for irregular employment, than to draw it from the savings of the working group."—Henry S. Dennison.

A Metal New in Industry

TANTALUM is a rare metal that has lately been brought out on a commercial scale, due chiefly to the demands of the radio industry. The metal is now being produced in wire, sheet, tubing, and special shapes. Its great resistance to acids makes it valuable for making various kinds of instruments, and the physical and chemical properties render it especially adaptable for electrodes and structural parts in radio tubes. Tantalum is also being used as a "getter" in radio tubes. It is welded to the plate in such a place that it becomes heated to red heat during the flashing operation, and insures a much more uniform run of tube.

Tantalum resembles steel in color, and will take a fine polish. It can be given wonderful iridescent colors after the article is fabricated. The melting point is very high, being given as 5,018 deg. F. The metal can be worked cold, can be drawn, machined, punched, and hardened. It cannot be soldered, but it can be welded to itself and to other metals. When heated, it becomes very brittle. Hydrofluoric acid seems to be the only chemical agent that will attack it, and in the case of pure metal, the action is very slow. If tantalum is heated in the air, the surface becomes blue at a temperature of about 400 deg. C., and at a somewhat higher temperature it becomes nearly black. Above a dull red heat, the white oxide is produced, and the metal gradually burns. Tantalum is more resistant to corrosion than any known metal or alloy. The tensile strength of the metal is about 130,000 lb. per square inch.

Power Required to Cut Metals

IN ORDER to get the best results out of a machine, it is necessary to apply enough power to enable it to cut as many cubic inches per minute as the machine, the cutting tool, or the work will economically stand. The power required is apt to vary somewhat according to

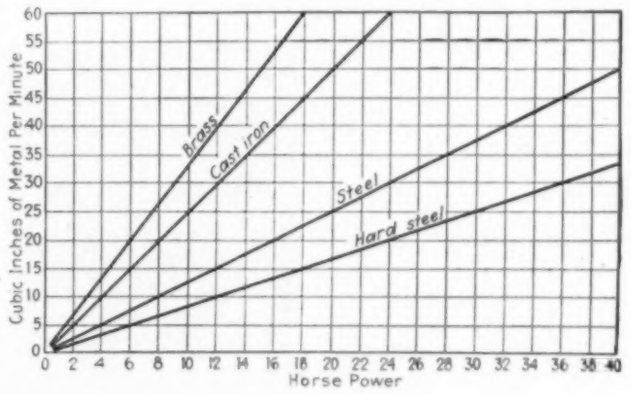


Chart showing power required to cut metals

the machine being used, and according to the condition of the cutting tools. However, the accompanying chart shows the results obtained by a long series of tests, and is believed to cover average conditions satisfactorily. These tests were made with a power meter under the direction of W. W. Nichols, Vice-President of D. P. Brown & Company. The line on the chart marked as steel, represents steel up to about 40 carbon, and the line marked hard steel represents higher carbon and alloy steels.

· BOOK · REVIEWS ·

HANDBOOK OF POSITIVE HEALTH. 1928 Revised edition. Two hundred pages, 6x9 inches. Illustrated. Cloth boards. Published by the Women's Foundation for Health, Inc., 370 Seventh Ave., New York City. Price $1.50.

WITH the rapid increase in the number of women workers in industry and business and the accompanying change in their habits of living the problem of health promotion and preservation has assumed serious proportions. This handbook is tangible evidence, that one organization at least is doing what it can to find the answer.

Beginning with a clear analysis of the present-day health situation, the Handbook goes on to parallel each point of the positive program of the Women's Foundation for Health with a chapter containing the fundamentals of health building pertaining to that particular phase. For example, the second chapter takes up the health examination, both medical and physical, with interpretation of the Foundation blanks and suggestions for both individual and community ways and means of following out these interpretations.

The remaining chapters are given over to the follow-up of that examination and run as follows: *Good Body Mechanics,* fully illustrated to meet type and occupational needs; *Nutrition,* adequately covered for the lay individual in two articles, one by E. V. McCollum, Ph.D., and the other by Mary Swartz Rose, Ph.D.; *Work and Rest*—the relation of fatigue to health and efficiency, by Lillian M. Gilbreth, Ph.D.; *Recreation,* by Walter B. Cannon, M.D.; and last, *Mental Health,* by Jessie Taft, Ph.D., who contributes "Bringing up Children" and "Adolescence," and William A. White, M.D., who closes the book with "Living At Our Best."

THE ROAD TO PLENTY. By William T. Foster and Waddill Catchings. Two hundred thirty-one pages, 5½x8 in. Published by the Pollak Foundation for Economic Research, Newton 58, Mass. Price $2.

BOOKS on economics are very generally dry affairs to the average business man, but the authors of this volume have gotten away from the routine, and have produced a story that many men will want to finish at one sitting. They have introduced a group of interesting characters in the smoking room of a pullman, and have had them discuss to a finish some of the most difficult of our every-day industrial problems.

Why should we have periodic depressions? Why must industry periodically fear overproduction when millions are actually feeling underproduction? One workman, who needs shoes for his children, is eager to make woolen cloth. His brother, who needs clothes for his children, is eager to make shoes. But neither man is allowed to go ahead and work. These are some of the problems taken up and discussed in an interesting manner. The authors have provided a remedy in theory, but to be effective it would require government action, and the setting up of some such guiding council for business as is represented by the Federal Reserve Bank in finance. The idea is not new, and is essentially the same as the Council of Five Hundred that has been developed in Russia. But in America it is felt that there exists most favorable ground to work on, as the needed statistics are already being gathered by trade organizations and federal bureaus, and business itself is well organized to benefit by such a guiding unit. The book is well worth the serious consideration of anyone interested in the economics of business.

PRINCIPLES OF METALLURGY OF FERROUS METALS. By Leon Cammen. Two hundred two pages, 6x9 in. Indexed. Published by The American Society of Mechanical Engineers, 29 West 39th St., New York City. Price $2.50, or $2 to A.S.M.E. members.

THE material of this book has been arranged with the idea that metallurgy is no longer something that is confined to the mining engineer or steel-mill operator. The wide range of special alloys now employed in the shop has made the microscopic study of metals a necessary part of our industrial and commercial practice. The author believes that engineers now need information on this subject in order to deal intelligently with problems involving metals and their application. Part of the material in the book was originally published in a series of articles in the journal of the society, but is now reprinted with revisions and additions.

The book is divided into eight chapters, the first two chapters taking up the physical and chemical properties of iron alloys and the crystalline structure of ferrous metals. The subjects are not easy to treat in a popular manner, but the author has succeeded in making a very readable text for mechanical men who have not been trained in chemistry and metallurgy. Heat-treatment is discussed in a separate chapter, and the properties of various cast irons and alloy steels are then explained, showing the effects of additions of alloying elements on these metals. The last two chapters are devoted to forging and casting, especially written for mechanical engineers who are called upon to specify forged or cast parts in their designs.

PITMAN'S DICTIONARY OF INDUSTRIAL ADMINISTRATION PART I. A comprehensive encyclopedia of the organization, administration and management of modern industry. Edited by John Lee, with contributions by over 100 eminent specialists. Published by Sir Isaac Pitman & Sons, Ltd., London and New York. Price $0.40.

THIS dictionary is to be issued in about 30 fortnightly parts and aims to cover a wide range of subjects allied to modern industry as outlined in the subtitle. The present part begins with Acceptance and ends with that phase of Borrowing known as unhealthy finance. In between are such subjects as accidents, aerial ropeways, apprenticeship, atmospheric conditions in factories, and bonus. It is well printed on soft paper, easily readable.

CALENDAR SIMPLIFICATION. Issued by George Eastman, 343 State St., Rochester, N. Y., for free distribution. Copies on request. The movement for calendar reform has progressed to the stage where the formation of a national committee is in prospect. Sentiment among Government officials and industrial and business leaders is very generally favorable to the proposal, but the awakening of the interest of the general public remains to be done. This pamphlet gives the whole story and points out the advantages and disadvantages of a revised calendar to the average citizen. Comments and criticisms will be welcomed by Mr. Eastman.

An Unusual Crankshaft and How It Is Made

By J. A. Lucas

An outline of the machine and methods used in making the Lancia crankshaft from a solid forging, this construction being necessary by the staggered cylinders

THE use of staggered cylinders, as has been previously described, necessitates very close crankpin bearings and makes the usual type of forged crankshaft impossible. In order to secure crank webs thin enough to permit the close center distances, the crankshaft is turned from a solid forging of chrome-nickel steel. The forging is heat-treated at a temperature of 1,475 deg. F., and is tempered in oil, so as to secure a tensile strength of approximately 140,000 lb. per sq.in. After the centers have been carefully located so as to insure proper distribution of stock, the shaft end is turned on the lathe shown in Fig. 1. The tool block is so constructed as to clamp small cutting tools, as at *A*, on narrow supports in order to permit the tools to be fed in on each side of a flange. This tool block can be readily reversed and the large clamping nut *B* is an indication of its rigidity. There is also another tool block at *C*. The end flanges are faced and the ends and the center bearing are turned before leaving the machine. The sides of the end flanges and the forged blocks are milled in the milling machine shown in Fig. 2, the fixture holding three shafts. The shafts are clamped by the end bearings and are supported from underneath. The screws, as at *A*, raise the supporting blocks *B* into contact with the forging so as to support it during the milling operation. The adjusting screws are locked by the cross screws *C* after adjustment has been completed. The crankshafts are heat-treated and then returned to the lathe department for final turning. Two of the turning operations are shown in Figs. 3 and 4, both of which show crankpins being turned. The method of holding the crankshaft so as to secure the proper offset can readily be seen. The forging is held firmly and is supported close to the cut. A very ingenious arrangement is provided whereby the crankshaft is fed out of the chuck the desired amount, the tailstock being pulled back a corresponding amount at the same time. The method of feeding the crankshaft through the spindle is shown in Fig 5, while Fig. 6 gives considerable detail as to the construction of the holding device.

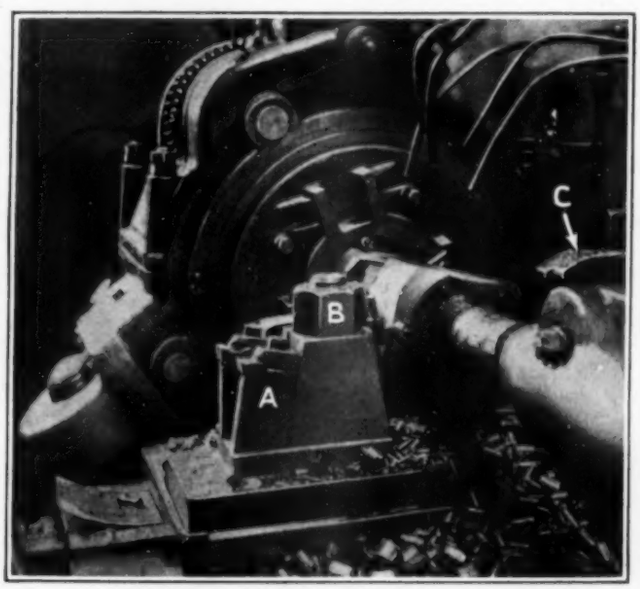
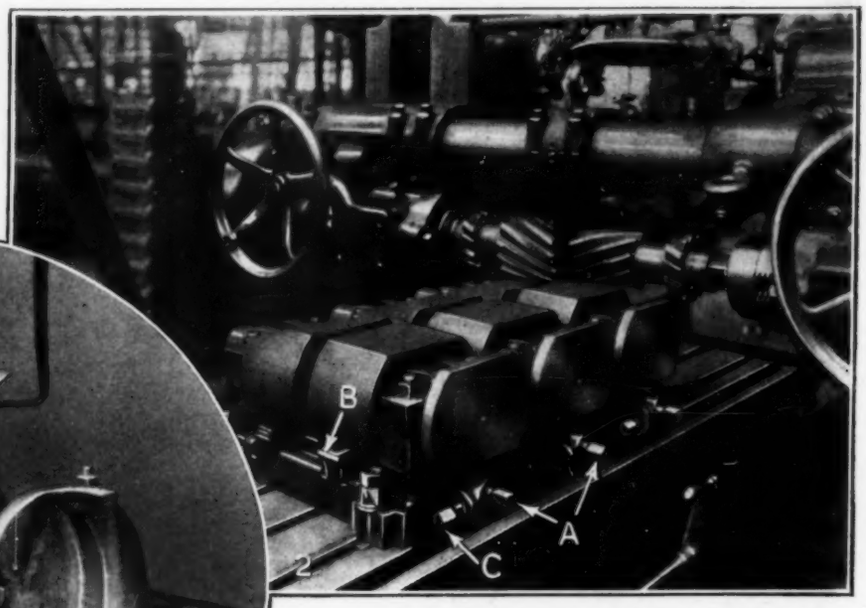


Fig. 1. First turning operation on crankshaft. The end flange is being faced and the end will be turned in this operation. The toolpost is somewhat unusual, carrying short pieces of high-speed steel on narrow supports to insure clearance between the flanges

The inner spindle that holds the crankshaft forging is in an eccentric sleeve which can be rotated so as to bring either the main bearing or any one of the crankpin bearings in line with the center of the spindle. The center attached on the outer end of the shaft is merely for support. The eccentric sleeve is fed through the main spindle by means of the rack *C* and the pinion *D*. Proper positioning of the crankshaft with regard to spacing the crank and the main bearing is secured by a substantial index pin at *E* and corresponding holes in the drum *A*. At the other end of the spindle are two hook shaped jaws *H*, with internally-threaded pinions on the inner ends, as at *J*. These jaws are operated by a gear on shaft *K*. Handle *L* at the other end, also shown in Fig. 5, controls the position of the jaws, turning them away to admit the crankshaft and closing them over the crankshaft flange for holding. Wheel *M* then draws the jaws in and holds the shaft firmly in place. The construction

Fig. 2—Milling the sides of the cranks after the end flange and main bearings have been roughed out. The crankshafts are located from these milled surfaces for future operation



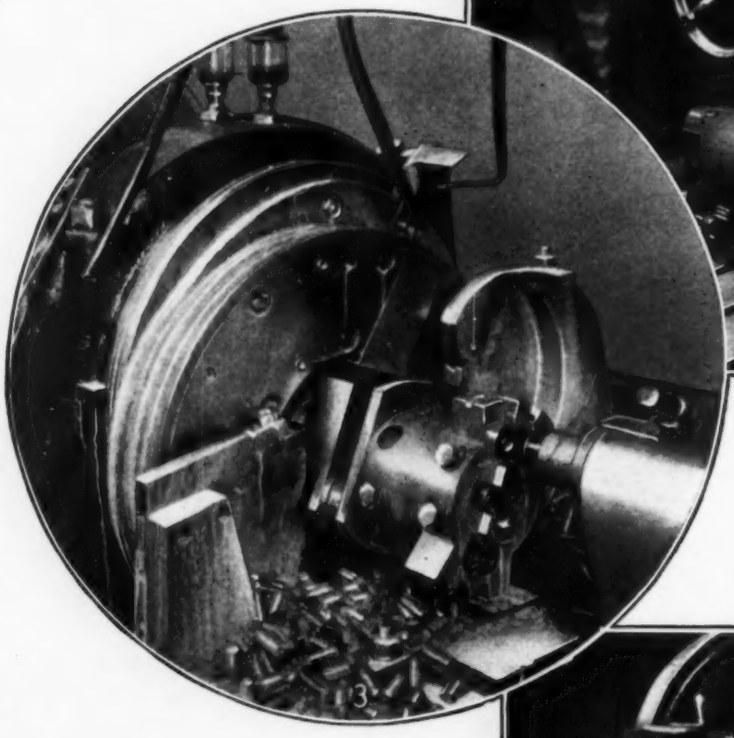


Fig. 3—Turning the crankpins. Here the shaft is mounted in a special lathe having a spindle with an eccentric sleeve so that the shaft can be swung to position for each crankpin. The shaft is supported close to the cut to prevent overhang and to avoid spring. The outer end is supported in the usual manner

Fig. 4—Another view of the same operation with the shaft extending out of the chuck in position for turning the third crankpin. This view shows how the two crankpins that are in line are turned at the same setting of the eccentric sleeve

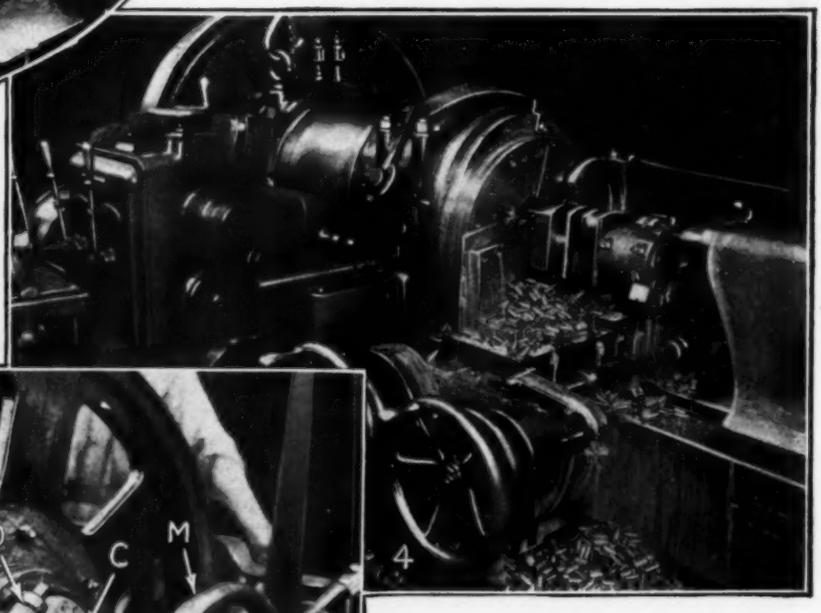


Fig. 5—Rear end of crankshaft lathe, showing how the eccentric sleeve is adjusted for different crank positions. One of the index holes that insure the different crankpins being located in the proper position, may be seen

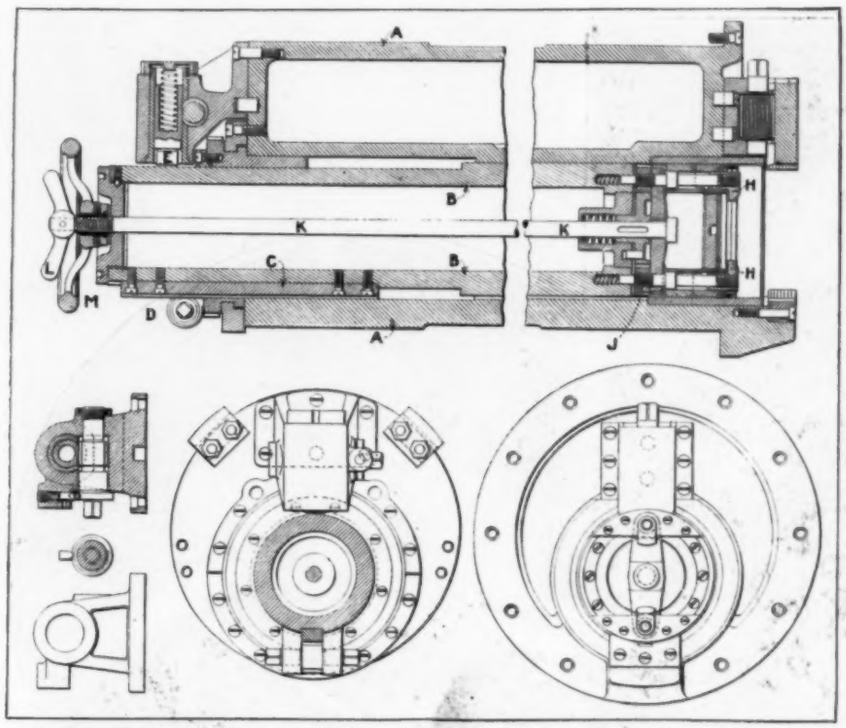
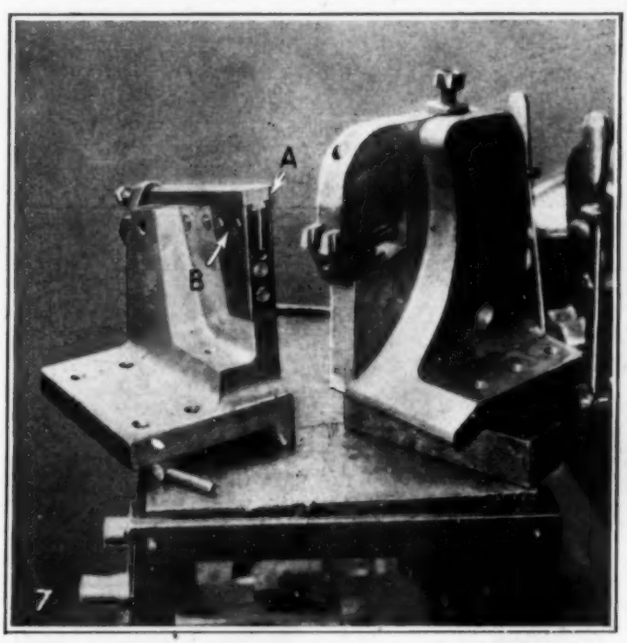


Fig. 6—Details of the crankshaft positioning mechanism. The construction of the spindle and its eccentric sleeve is shown, as well as the method by which the crankshaft is indexed to center the pins with the spindle

of the toolblocks used in turning the different bearings on the crankshaft are shown in Fig. 7. They are specially designed to support the cutting tools firmly, and at the same time afford ample clearance on each side for the throws of the cranks. The tools are held in their supports by dovetailing, as can be seen at *A* and are fed forward as it becomes necessary by a screw at the back. The tools are sharpened by grinding the front ends to the proper clearance and are clamped at any desired adjustment by the screws *B*. The other tool is for facing down each side of the crankshaft webs, and follows the first tool. It has been found much more satisfactory to divide the work up in this way than to attempt to do it all with a single tool. In Fig. 16, details of the toolblocks are given. A central hole for lightening the weight of the crankshaft is drilled in the fixture shown in Fig. 8. Here the shaft is positioned by the two V-blocks *A* and is held by two clamps, one being shown at *B*. The second clamp is not in place but the clamping bolt is shown. The bolt holes are drilled in the flange for attaching the flywheel, in the fixture shown in Fig. 9. The construction of the fixture is shown too plainly to need special description. At the right is the fixture in which the crankshaft is held while oil holes are being drilled in the different bearings. This fixture is mounted on the regular table of the drilling machine and can be swung under the drill spindle after the other fixture has been removed.

Details of this fixture are shown in Fig. 10, which shows how the crankshaft can be positioned at any desired angle for the holes in the different crankpins and



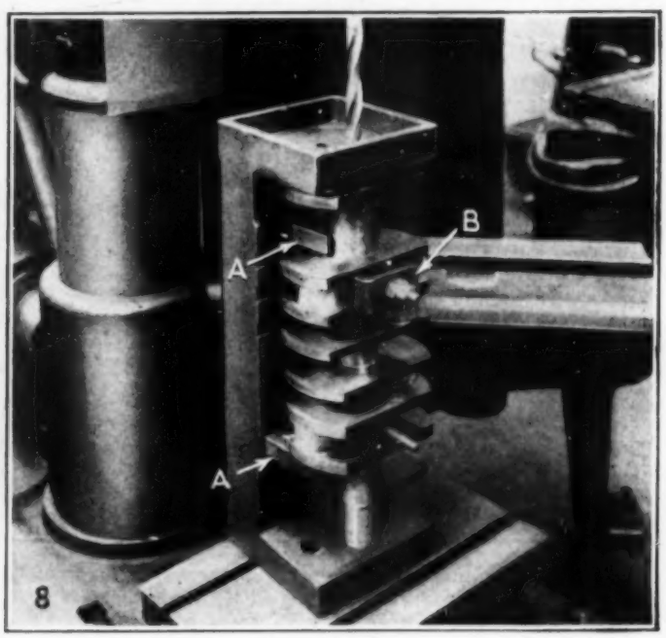


Fig. 7—Tools and toolholders for finish turning the crankshaft bearings. The tool at the left is dovetailed along its entire lower side and is fed forward into the work by a screw at the back. This tool is closely followed by the two tools in the other block, which face down each side of the web. These tools have increased output and decreased tool cost. Fig. 8—Drilling a hole through center of shaft for lightening its weight. This is a simple fixture and the way in which the crankshaft is positioned and held can readily be seen

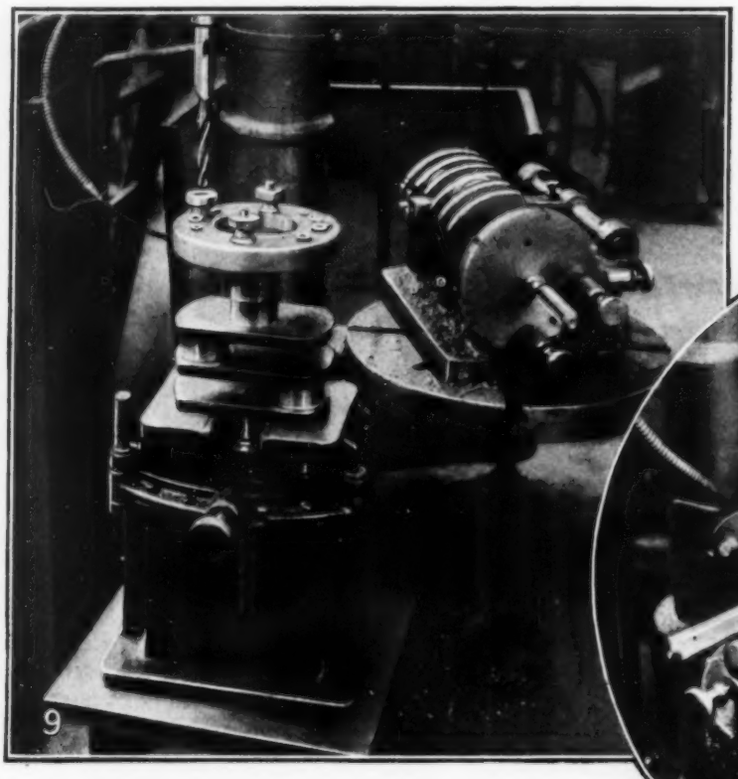


Fig. 9—Drilling the flange for attaching the flywheel. The method of supporting the crankshaft and attaching the drill gage block can be seen. This fixture is mounted on an auxiliary table so that by removing it the regular table and fixture at the right can be used

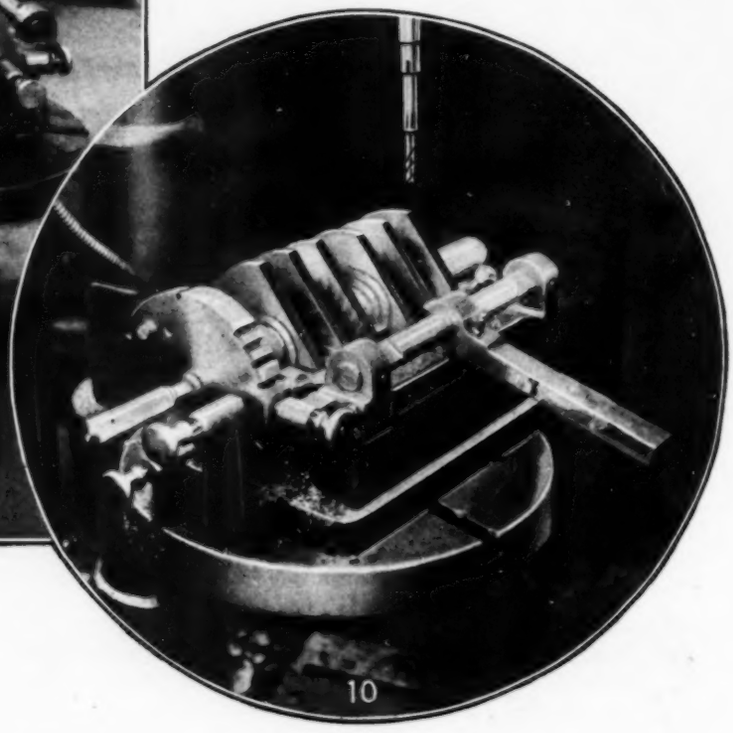
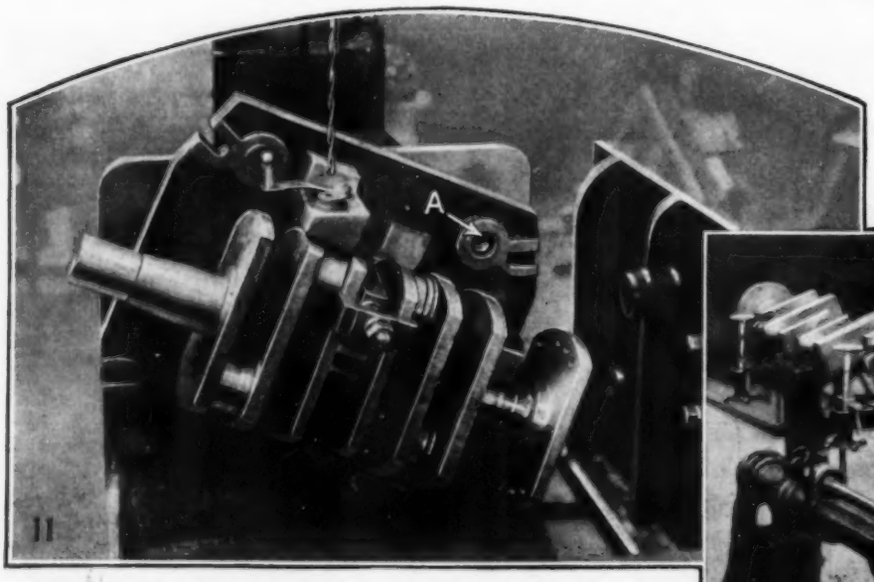


Fig. 10—Fixture for drilling oil holes in the various bearings. This view shows how the crankshaft is supported in the fixture and how it can be positioned at various angles so as to have the oil holes in the positions desired



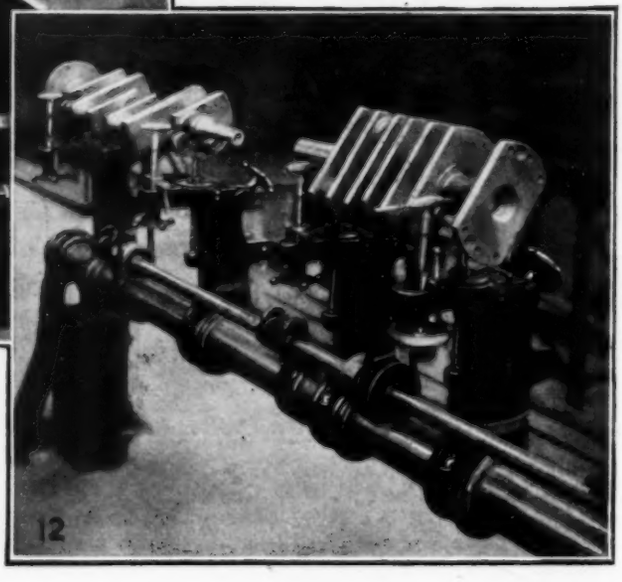


Fig. 11—Drilling oil passages from crankpin to main bearing. This fixture is pivoted in the center so that it can be revolved to drill the oil jassage from the fourth crankpin to the rear main-bearing

Fig. 12—Balancing the finished crankshaft on a Norton machine. The crankshaft is revolved on rollers by a belt from the shaft below to the central main bearing

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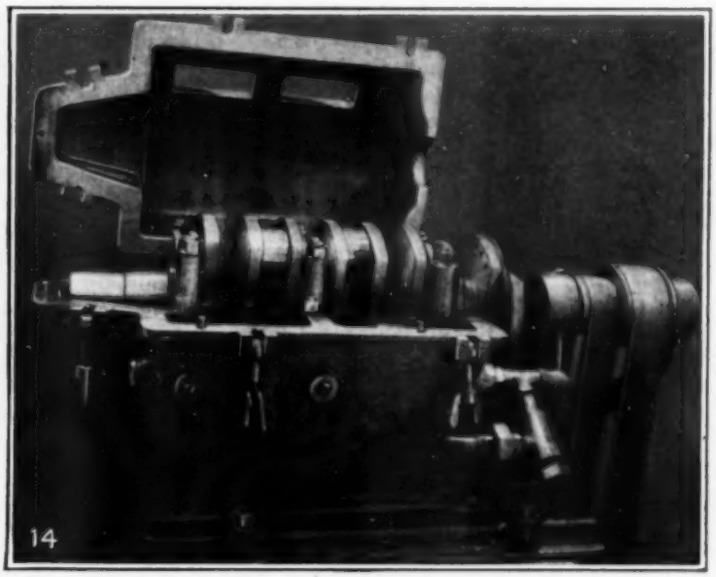
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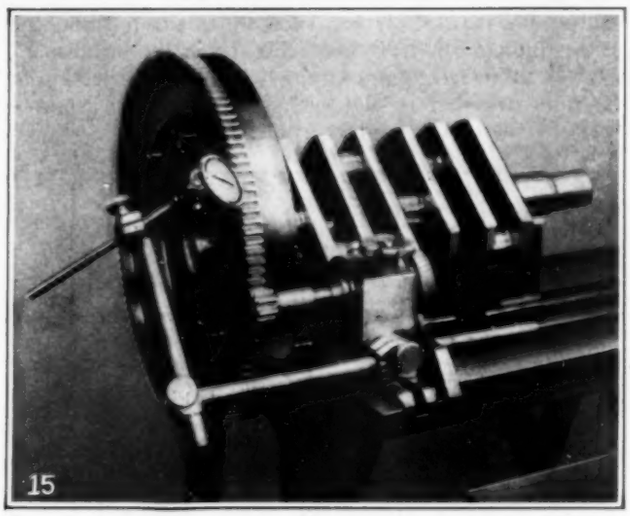
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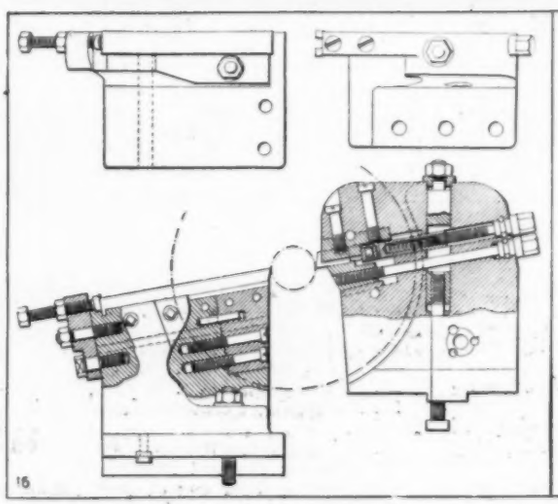
Fig. 13—Inspecting the completed crankshaft. The inspection bench, the method of mounting the crankshaft and the 24 gages used in inspecting the various dimensions. Extreme care is exercised in securing both concentricity and parallelism of the various bearings

Fig. 14—Washing the crankshaft before assembly. The shaft is mounted in a special crankcase that is filled with a washing compound, and in which the shaft is revolved through the belt at the right

Fig. 15—Checking the concentricity and the bearing of the starting gear and pinion. After the flywheel has been bolted to the crankshaft, it is mounted in the fixture shown to test its truth and that of the starter gear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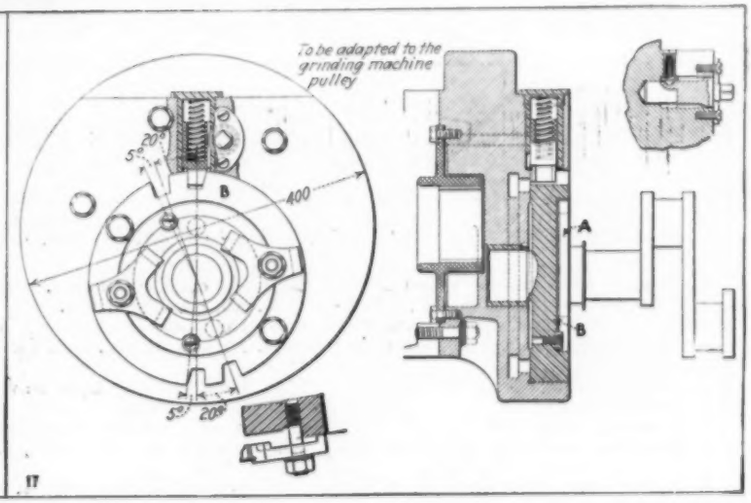

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Fig. 16—Details of the toolblock. The drawing shows the manner of holding the tools in both front and back positions, and of securing the adjustment to compensate for resharpening. Fig. 17—Fixture for holding crankshaft for grinding crankpins. The angularity of the cylinders makes it necessary to offset the crankpins. The index plate and pin locate the shaft in the correct positions, successively, for grinding each of the crankpins

main bearings. Another fixture for drilling oil passages is shown in Fig. 11. Here an oil hole is being drilled from the second crank pin through the third web and into the central main bearing. This fixture is indexed by a pin as at *A* and can readily be swung into the opposite position for drilling from the third crank pin back to the center bearing.

After the usual finish grinding of the crankpin and the main bearings, the final milling cut is taken on the sides of each web, the crankshaft being located from the bearings that have been finish ground. This final milling operation has been found to assist greatly in securing the desired balancing of the complete crankshaft. A special fixture is used in grinding the crankpins so as to index them to match the angularity of the cylinders. Details of the fixture are shown in Fig. 17. The finished shaft is then balanced on a Norton machine as shown in Fig. 12, where two shafts are shown in place. The shaft is then ready for inspection.

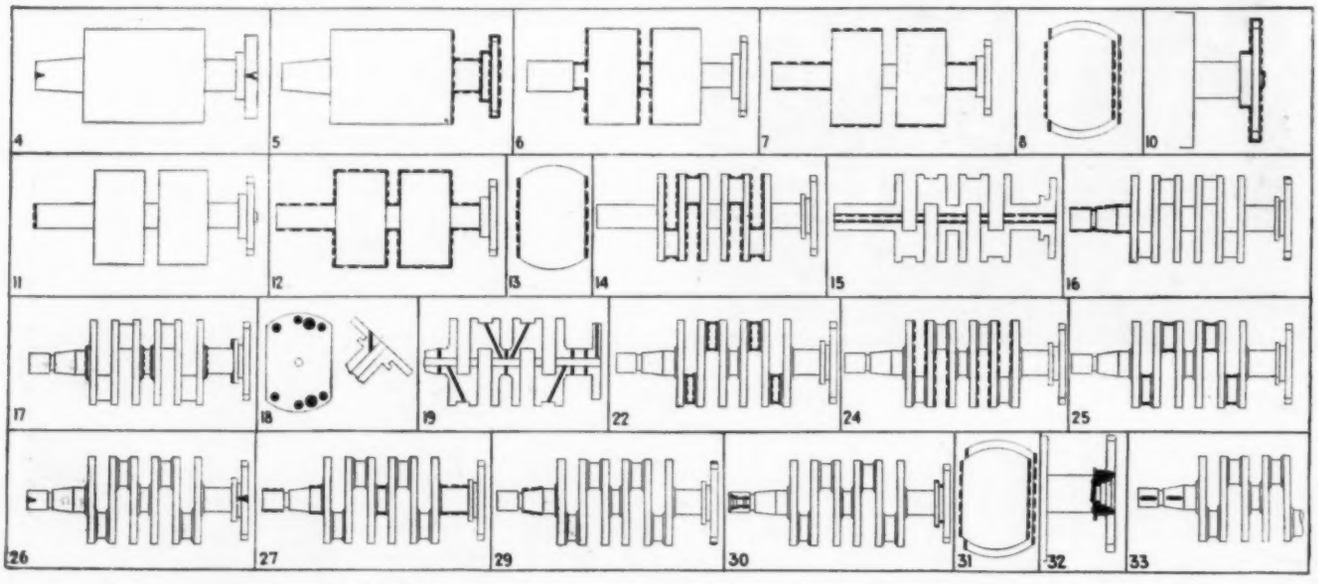
Anyone familiar with crankshaft inspection methods can readily follow the inspection of the shaft in Fig. 13 by a careful study of the various gages. One is impressed with the extreme compactness of the shaft and with the large diameters both of the crankpins and the main bearings. The shaft is mounted on portable stands carrying rotors so that it can be conveniently turned.

After inspection, the crankshaft is thoroughly washed by being mounted in the special crankcase shown in Fig. 14. The flywheel flange is driven by means of a friction disk at the right and the cleansing solution is forced through all of the oil passages. This operation thoroughly washes out all of the oil passages and insures their being clean so that there will be no question as to oil reaching every bearing surface.

After the flywheel and crankshaft have been assembled, the flywheel is tested as in Fig. 15, with both an indicator and a dummy starting gear. This combination checks the concentricity of the flywheel and gear and also checks the gear teeth as to contour and back lash.

The angularity between the two sets of cylinder bores makes it necessary to have the crankpins correspond. Hence the indexing arrangement on the crankshaft lathe, as in Fig. 5. In grinding the crankshafts, it is necessary to maintain the same offset indexing of the pins, the fixture for this operation being shown in Fig. 17. This fixture holds the shaft in the proper position for crankpin grinding, the flange being held as at *A*. Then by indexing the carrying plate *B* the crankshaft can be turned to grind any one of the four crankpins.

After the crankshaft has been finish ground and the various dimensions have been checked in the usual manner, it is subjected to an extremely rigorous inspection to determine whether or not each crankpin is in accurate alignment with the main bearings.



The diagrams show the major operations on the crankshaft. The sequence of operations is given below

1. Forging from chrome nickel steel.
2. Treatment at 1,470 deg. F. Tempered in oil in secure tensile strength of about 140,000 lb. per sq.in. Brinell test for hardness.
3. Locating centers from outside.
4. Drilling centers.
5. Roughing flange and facing in lathe.
6. Roughing central portion and bearing.
7. Turning outsides of cranks.
8. Milling sides of flanges.
9. Heat-treatment and hardening.
10. Finish turning flange.
11. Remove center bosses and finish end to length.
12. Grinding center journals, flange faces and outside of flange.
13. Milling rear flange.
14. Roughing crankpins.
15. Drilling central hole for lightening shaft.
16. Rough turning taper on thrust bearing and rear flange.
17. Rough turning thrust washers of main bearing and oil flange, and facing rear flange.
18. Drilling angular holes in rear flange and locating points for oil passages from pins to main bearings.
19. Drilling central oil holes.
20. Drilling rear flange and angular hole to crankpin.
21. Removing burr from drilled holes.
22. Grinding sides of flanges of crankpins.
23. Finish turning crankpins.
24. Finish turning crank webs.
25. Grinding crankpins.
26. Refinishing centers from main bearing.
27. Grinding main bearing.
28. Grinding flywheel flange.
29. Grinding taper end of shaft.
30. Finish grinding oil flanges.
31. Finish milling flanges.
32. Threading oil retainer on bearing.
33. Milling keyways.
34. Complete inspection.

How Determine Allowance for Parts Ordered Omitted from a Machine?

"DO YOU mind if I intrude with a little business, Bill?" asked Mr. Hare, the banker, as he dropped into a chair alongside Mr. Holland at the club.

"Not at all, Frank. What's troubling you?"

"I've been asked to serve as referee again. Here's a manufacturer of crank presses who sells a certain machine to an agent at list less 15, less 10, less 10. He sells that agent a crankshaft for the same machine for list less 10, less 5. Now the agent has ordered a press without crankshaft and the question arises as to how much he shall be allowed.

"I don't know what the agent wants, but I do know that the manufacturer thinks he would be giving a fair deal if he deducted 15, 10 and 10 from the list price of the crankshaft, then deducted the balance from the list price of the press, and from what was left figured the agent's discount of 15, 10 and 10."

"And the agent doesn't like that, Frank?"

"I don't think so, Bill. Several compromises have been suggested. One of them is the deduction of 25 per cent from the list price of the crankshaft and the deduction of the remainder from the list price of the complete machine before figuring the agent's discount of 15, 10 and 10. Another is to split half and half the difference between the crankshaft discount at 15, 10 and 10 and at 10 and 5. The latter involves a new set of discounts, namely 10, 10 and 5. It seems to me that no one of these solutions is based on definite principles."

"It's a hard proposition, Frank. The same problem has been brought to me many times. One thing certain is that the full allowance of list price less 10 less 5 cannot be made for the crankshaft. There are several things to be considered, among them the added cost to the manufacturer of order records in office and shop; the reduced profit on the machine due to omission of the part; storage and handling charges of the omitted parts that must be produced and held to be supplied on order; the possibility of an irregular shop force due to the manufacturer's not knowing what to expect in the way of orders for complete machines and for machines with parts omitted. Not all of these considerations apply in the case of a press without crankshaft; but they do apply in establishing principles and precedents.

"I am very much inclined toward the method of figuring such allowances adopted by several of my business acquaintances. They say that the manufacturer will be giving the agent a fair deal if he subtracts from the list price of the complete machine the factory cost of the crankshaft, including overhead, and allows him to take his discounts from the remainder."

"That sounds definite, anyway, Bill. In all probability I'll offer it as my solution, if you don't mind."

"Not at all, Frank. I have no monopoly on it. I'll be glad to hear how it is received."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Allowances for Old Machines

Henry Wilson, general manager of the gear plant, should not be criticised for wanting to trade in his old gear cutting machines as part payment for new machines of the same manufacturer—The Stanley Company.

Wilson is right; his old machines do possess some value. The Stanley Company should recognize that fact and provide a channel for their distribution, either through a rebuilding department, or to be sold "as is."

It may not be the *duty* of the machine tool builder to purchase back and rebuild used ma-

chines of his own make, but if he wants to hold his valued accounts he should maintain an efficient rebuilding department as a part of his merchandising service.

Would you buy a new car if you first had to sell your old one, *yourself?* Yes, you probably would if you had to—but the wide awake automobile fellows have eliminated that bother for you. So have a few of the more aggressive machine tool builders, and many others will soon fall in line—or else "by the wayside."

If I were Henry Wilson, I should carefully investigate the used machinery market; find out which machine tools possessed the highest resale value, and which makers maintained a rebuilding service; and I should place my orders for new equipment accordingly. —GEO. L. ERWIN, JR.

Handling Decreased Production

Decreased production is a problem that probably demands a different solution each time it presents itself to a given individual. The leads given by Mr. Holland as aids towards establishing the fundamental facts on which to base a decision should assuredly help in developing a satisfactory solution. The matter of overhauling machinery and making "stand-by" factory repairs at such a time may also be considered a partial contribution toward the problem of handling decreased production.

Perhaps it would be well to delve even a little deeper into the underlying facts before arriving at a decision. If the depression is universal, or practically so, throughout the machine tool industry, then the answers to Mr. Holland's leads will govern, for the machine tool industry is the pioneer essential industry and must come back. If, however, the depression is confined to a particular branch of the industry, it may be well to dig in a bit before making up parts or assemblies for stock, to find the cause.

Just as there is always more than one way to do a given job, so, too, changing and improving production methods sometimes affect a whole branch of the industry. The change may take place in an entirely different operation (i.e. say, welding for riveting) than the one the type of machine under consideration is used on, yet its changing effect will be felt. If the depression seems to be confined to his own machines in particular, Mr. Hawthorne had better study the mechanical improvements made by his competitors, as well as his own sales, advertising and service departments, before he tackles it solely as a problem in handling decreased production. —WILLIAM W. DAY.

Charging a Profit on Material

In my estimation charging a profit on material is incorrect. I have followed the practice of charging an average of ten per cent for purchasing, handling, and storing.

An attempt to charge a profit on material used for any work is an injustice to the purchaser of the product. To illustrate: When a machine is built or fabricated for a customer this customer is paying for the actual fabricating or building. In some cases the machine builder furnishes the materials and in some cases the customer supplies them. This applies to small plants. When the customer discovers he is being charged a profit on material his good will, possibly his business, is lost. He is not interested in how the material is secured. The actual cost of the materials must be known and the profit must come out of the actual fabricating of the product.

—PAUL LINDNER.

Mr. Holland is quite correct in adding a percentage to cover the cost of handling raw materials when setting the price on the given job. In a great many cases this charge is taken care of automatically when setting the selling price by figuring this expense as an overhead item. The selling price is determined from the cost of manufacture, the overhead required to supervise that manufacture, plus a predetermined profit.

All of the expense items necessary to the purchase of raw materials, such as the time of the purchasing agent, time required for correspondence, postage, telegrams, material handling charges, etc., are classified as overhead. Figuring the material cost directly from the invoices received from the vendor, without handling, will greatly simplify office procedure. By carefully figuring the overhead to be charged to the cost of a given group of parts, the extra amount Mr. Holland talks about is automatically taken care of.

—H. K. KEEVER.

How Much Salary Should the Head of the Business Draw?

The neglect of the head of the small business to charge for all the extra tasks he performs is by no means the whole cause of the concern's difficulty in showing a profit. In fact, the value of his services as janitor or bookkeeper often may be offset by the cost of the consequent mistakes, due to his neglecting his job as president.

To make a profit a firm must take in from customers more than it spends on payroll, materials, plant, and machinery. This requires a cost system under which the total amount billed the customers in each year must absorb the total manufacturing and plant expenses. Most small businesses regard such a cost system as a luxury and continue to guess that their overhead expense is about 100 per cent of their direct labor charges. A 10 per cent error in this guess is enough to bankrupt a business.

Every business has to take orders occasionally at a loss. The firm with a cost system knows what its loss is on such jobs, and knows too, what jobs are bringing in the profits.—C. S. HAZARD.

Reconditioning Driving Boxes at Paducah

By Frank W. Curtis
Western Editor, American Machinist

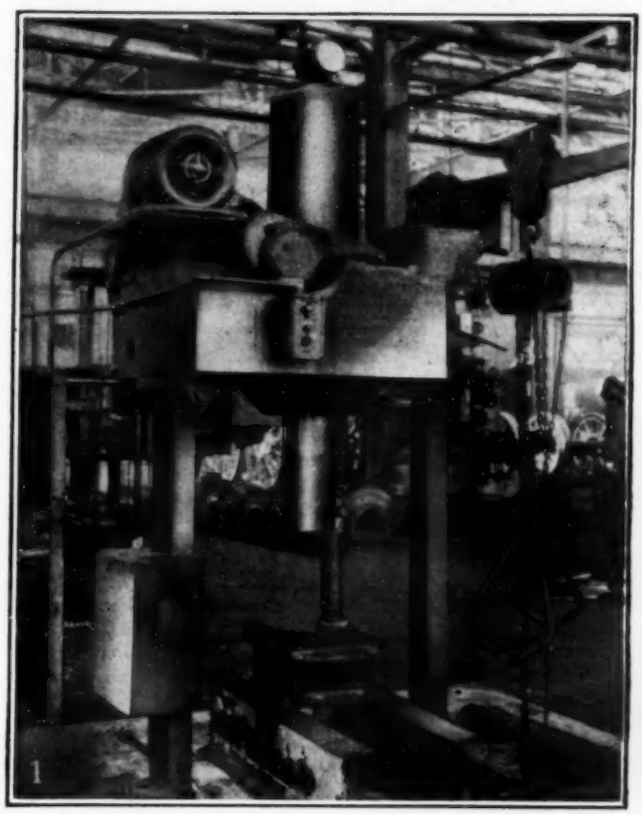
Methods of reconditioning driving boxes together with details of some of the operations performed, including boring crown brasses and welding hub liners in place

DRIVING-BOX work at the Paducah, Ky., shops of the Illinois Central System is handled in a section of the light machinery bay located at the east end of the locomotive department, which is equipped with adequate facilities for the maximum output. After driving boxes have been removed from an engine they are taken to a lye vat, located in the yard just outside the driving-box department and are given a thorough cleansing. The first shop operation is the removal of the brasses, after which the boxes are given an inspection to determine their condition, and then marked according to the operations required for reconditioning. If weak spots or cracks exist, they are welded, thus putting the castings in a sound condition.

If the overall width of the shoe and wedge faces is $\frac{3}{4}$ in. or more undersize, liner plates are arc welded to the box and then machined to width. New brasses are made and fitted to the box and then pressed in. Following these operations, a brass hub-liner is machined and welded to the hub side of the box, completing it for the final machining which consists of the rough and finish boring of the crown brass and the facing of the hub liner.

A driving box set up in a hydraulic press for the

The fifth article of seven. The sixth will appear in an early issue.



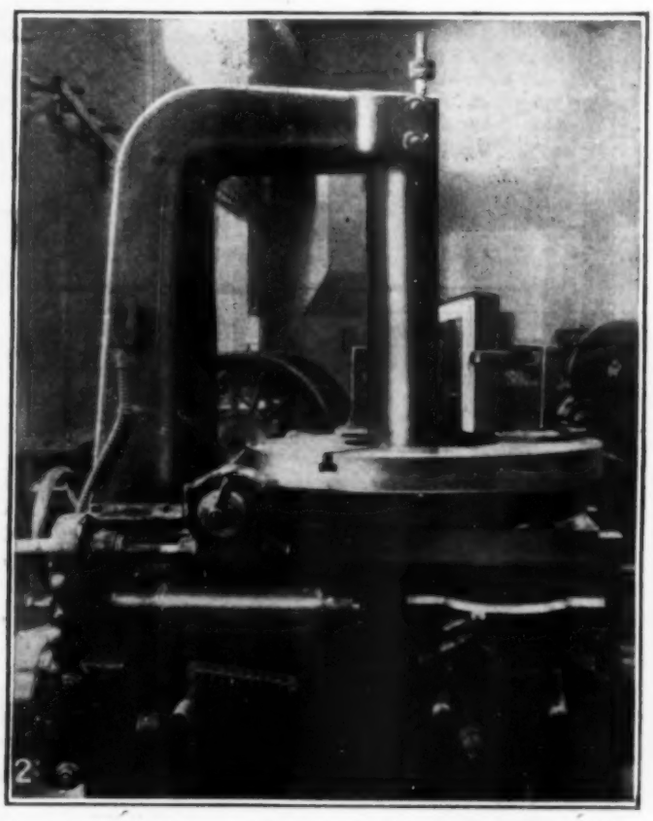


Fig. 1—After driving boxes have been removed from a locomotive and cleaned in a lye vat, the brasses are forced out in a hydraulic press. The work is set up on two I-beams so that the brass will have sufficient clearance to pass out. Another machine of similar design is available for pressing in new brasses. Fig. 2 — Oil grooves of crown brasses are milled in this machine before being pressed into the driving box. The work is clamped in a fixture, attached to a rotary table, its inner surface being placed parallel with a vertical spindle in which an end mill is held. Either straight or angular grooves can be machined by changing the gearing

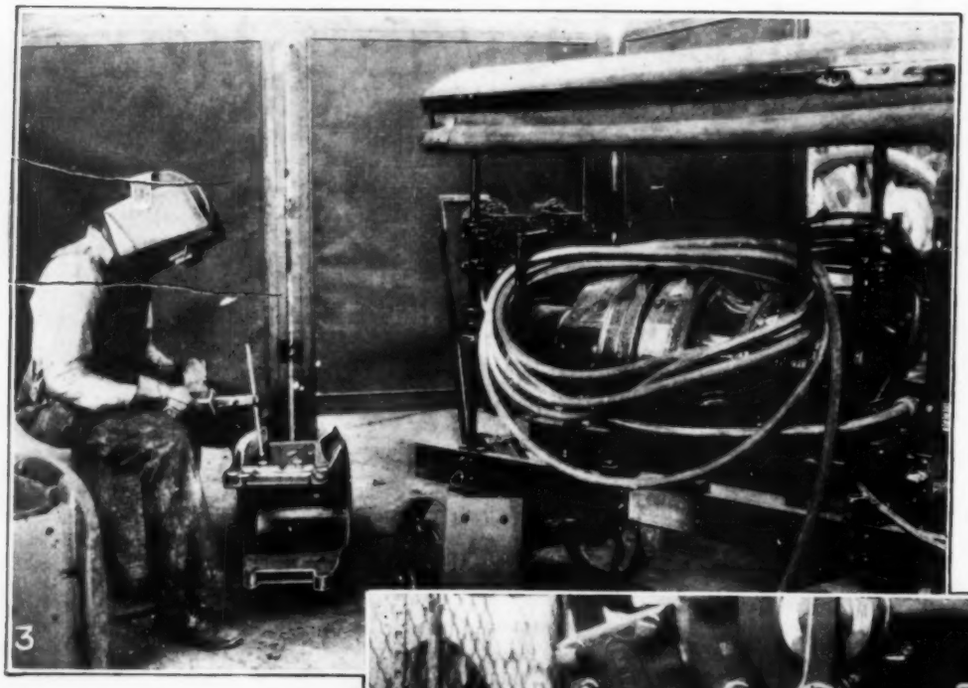


Fig. 3—An electric arc welder is used to attach liner plates on worn shoe and wedge faces. Five holes are drilled in the plate to enable the welding metal to be tacked to the driving-box body and to the plate, thus making a solid joint

Fig. 4—Hub plates are machined in a vertical turret lathe. The work rests on parallels and only a small amount of the diameter remains unturned. The opposite face is machined after assembly to the driving box

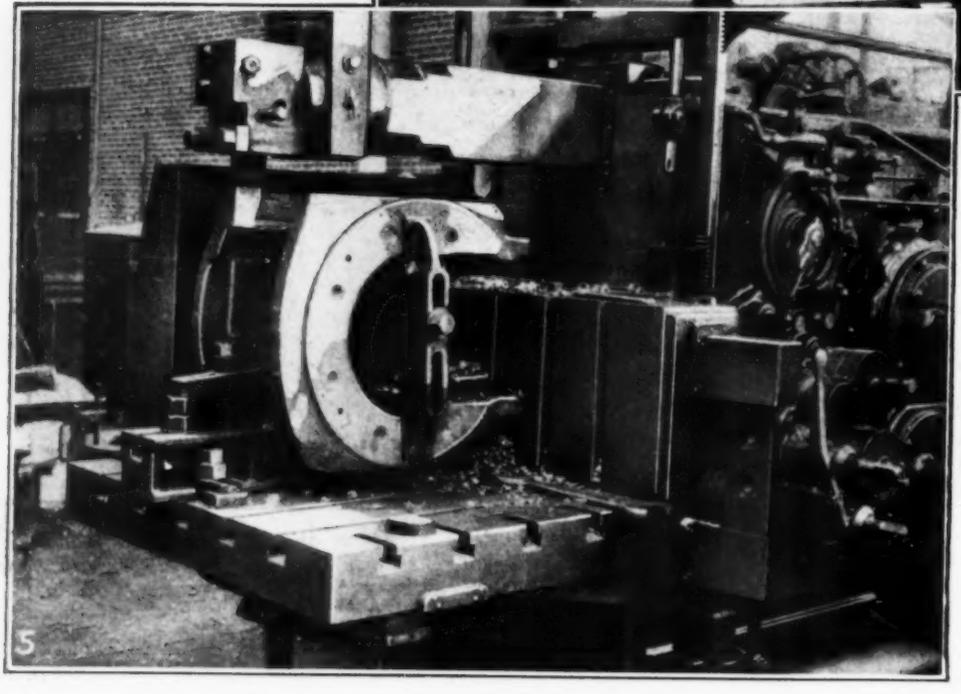


Fig. 5—Machining the shoe and wedge faces of a driving box in a draw-cut shaper. Two machines of this type are available for the handling of miscellaneous driving box operations. The work is located against an angle-plate and is held in place by a strap clamp

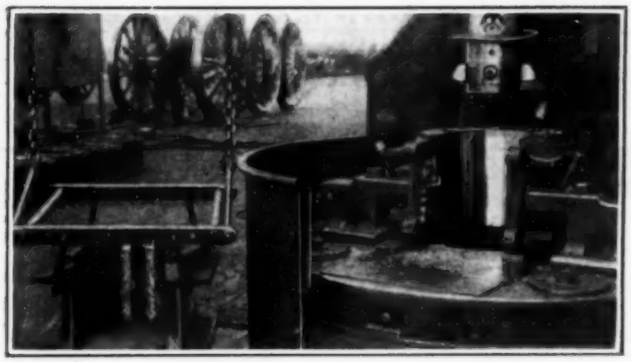


Fig. 6—Crown brasses are bored and liners are faced in one setting in this machine. A two-jaw chuck holds the work from the shoe and wedge faces so that the bore will be properly aligned with these faces. An air-operated jib crane is attached to the machine for loading the work

removal of its brass is illustrated in Fig. 1. The box rests on two I-beams in order to give sufficient clearance for the brass to pass out. Two presses of this type are in use, the second one being used for assembling the brasses. Each press has a jib crane attached to it.

Oil grooves are machined in crown brasses before being assembled to the driving boxes, the operation being performed in the grooving machine illustrated in Fig. 2. The work is placed in a fixture that has two hook-bolt clamps arranged to hold it, location being obtained from the outer surface. Either straight or cross grooves can be cut in the machine, although the majority of brasses are given three straight grooves.

In welding liner plates to the shoe and wedge faces of driving boxes, the practice is to drill five ¾-in. holes through the plate and then to fill up the holes when applied, enabling the welding metal to be tacked to the driving box as well as to the plate, thus making a solid connection. One of the portable arc welding units used in the operation, as well as in miscellaneous work throughout the shops, is illustrated in Fig. 3. A drilled plate is shown standing at the front end of the welder, and at the left is shown an operator tacking a plate to one side of a driving box.

Hub liners, made of brass, are machined on one side and turned to diameter in the vertical turret lathe as illustrated in Fig. 4. They are then assembled to the driving boxes by welding, employing a practice similar to that used for attaching liner plates to the shoe and wedge faces. The work is held in a four-jawed chuck, being supported on parallel blocks enabling the greater part of the outer diameter to be machined. The opposite face of the liner is finished after assembly, which is arranged so that sufficient metal can be removed to take off the unturned portion of the liner. After a liner has been assembled, the driving box is clamped in a draw-cut shaper as shown in Fig. 5, where the shoe and wedge faces are machined.

Boring the crown brass and facing the hub liner are the final operations. In Fig. 6 is shown a driving box set up in a boring mill for these operations. A driving-box chuck locates and clamps the work from the shoe and wedge faces. After the boring tool has been started, the side-head facing tool is brought into action, enabling both cuts to be taken simultaneously. The machine has a built-in type of air-operated jib crane for loading purposes, and at the left is shown the lifting device attached to a driving box.

SEEN · AND · HEARD

By John R. Godfrey

Making and selling holes— Splitting operations

I RAN across a new line of special machine work the other day, in the shape of a purveyor of round holes. The size or length of the hole is made to the customer's order, holes from ⅝ in. in diameter and 6 ft. long and 2½ in. by 45 ft. long being in stock. In between were holes up to 8 in. in diameter, both through holes or blind holes being available for the asking—and paying the price.

Of course there was metal around the holes to keep them in shape. But that was quite incidental so far as the business of this shop was concerned. You can have a short, thick-walled hole or a long, thin-walled hole, or anything in between, and with any sort of finish in the holes. You can have them rough bored, or polished to a mirror surface, for the shop is an expert when it comes to holes. In some cases customers send shafts or spindles to be bored. But in nearly all cases they simply tell what size and kind of hole they want and how much metal they want around it, and the hole makers supply the forging rough turned and drilled, or bored to specifications.

It was a new business to me—as a specialty—but it's about ten years old—and growing, for boring long holes straight requires a "know how" that few shops seem to have.

* * * *

It is interesting to see how ideas and practices vary in machining work. In some shops we find the automatics doing everything including threading, slotting and cross drilling. In others the automatics simply do the straight turning and cutting-off, or what may be called making the blanks. This is true even with plain studs and ball race rings. The threading and chamfering are done on simple, second-operation machines.

This division of work isn't haphazard in any sense. Experience has shown, to the satisfaction of many at least, that the automatics pay bigger dividends on straight work than when they are slowed down for threading or other operations. We find second-operation machines, with hopper or magazine feed in many cases, that take the blanks made by the automatics and do the slower-speed jobs. This saves slowing down the more expensive machines, or having them lie idle while dies or other special tools are being adjusted.

There seems to be no question as to the advisability of using single-operation machines when the quantity warrants. They differ from single purpose tools in the strict sense, because, while they perform a single operation only, they can be used to perform any similar operation within their capacity by simply changing the tools and work-holding devices.

The Panama Canal seems to have more than justified the fondest hopes of its advocates from a commercial point of view, as well as for its military value. Tolls have increased from $4,363,550 in 1915 to $26,231,023 in 1927, which shows a real profit after deducting operating costs and interest on the investment.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Paying a Bonus to Outsiders

"THERE is no doubt in my mind that you and Williams answered that bonus question right, Al," said Ed, on the morning following their discussion *(see last week's issue)*. "What was the rest of the letter?"

"It presented another problem, Ed. Here's exactly the way it was put: 'Suppose an operative is walking by a job and sees like a flash that the work can be cut down by a certain change, and he takes that suggestion to the foreman who accepts it and finds that an actual saving can be made. Would it be practicable to pay this third party a bonus on the basis of a certain percentage of the money saved on all the parts made through this additional suggestion on that particular job? What, in your opinion, would be the reaction of the man doing the job?'

"And here's our reply: 'In the case of the operative not connected with a given job but who suggests a method by which the time on this job can be reduced, he should by all means be given a bonus or a reward for his suggestion. It is our opinion that a fair payment would be based on the total savings or estimated savings to result from his suggestion. The man on the job would probably be somewhat piqued that he himself did not make the suggestion, and if the new arrangement caused him to give greater output for the same wage he would probably feel that the other man had interfered with or butted in on his job. He might even go so far as to quit. On the other hand, if the new method were introduced in such a way that the man on the job could earn more than he had with the old method he would undoubtedly be satisfied, would feel that the other man had befriended him, and would believe that the company had at heart the interests of its men. He might, of course, continue to be disappointed that he himself had not made the suggestion, but that very situation might inspire him to future constructive work.'"

"I must confess that I can't find fault with anything you and Williams have said, Al. Perhaps that's because I don't know enough. Wish we could hear what others think."

"We'll have a chance, Ed. Williams is going to read the two letters to all the foremen the next time they get together."

Would you give the bonus for the suggestion? How would you figure it? Suppose you were the man on the job—how would you feel?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Discovering Hidden Ability in the Men

IF SOME department heads were less afraid of losing their jobs to the workers under them, many a profitable idea would be brought out and put into use. Many thoroughly capable men have been dwarfed by their superiors simply because they knew more about the job, and had more originality, than the boss. It would not be hard to dig out examples of departments whose heads are holding their jobs by pull rather than by push. The remark has often been made by works managers that "He never showed signs of originality while with us," when the fact of the matter was that the superintendent or foreman gave no heed to the ideas for fear of losing his own job. —RUSSELL J. WALDO.

IT IS quite possible that Al has discovered a faulty characteristic of many shops. If there is a dearth of material among the men for potential leadership, it is management's problem to discover it. But, on the other hand, if the organization has among its men those who show initiative and originality in the carrying out of their daily tasks, the opportunities should be placed at their doors rather than to hold them in abeyance while the search goes on for hidden qualities in the others.

In most instances, the man with the desired ability will naturally display it without waiting for someone to place a title on him as a license for him to function. As a matter of precaution, it is much safer to carry on this experimental work without establishing a definite title, for then, if the prospect fails, he need never know he has been tried and found wanting. —JOHN A. THOMSON.

Paternalism or Privacy?

PATERNALISM ! Ouch ! We went through some such sort of agony a short time ago. The "old man" came back from a convention of a "Society for Prevention of Cruelty to Unsophisticated Workmen," or something of the sort. Anyway, he was full of it. He instructed the foremen to fill out a questionnaire for each man; color, creed, race, married, size of family, age, own your home, any mortgage, any trouble to pay your debts, etc., perhaps 20 questions like these.

Now, don't get the idea that the boss is a crank. We like him. When Jim finished the repairs on the propeller shaft of Mrs. X's yacht in one day less than promised, he found a $5 gold piece in his pay envelope in addition to his overtime. When Jimmy had a bad case of twins at home and lost a day to take his wife to the hospital he did not find any deduction in his pay. But this time, we began to have doubts about the old man's sanity. Some of us answered some questions, as a matter of courtesy. Some got sore and threatened to leave rather than submit. The foremen could not attend to their business, and men found themselves waiting for work, and started an indignation meeting, which took more of the foremen's time to disperse. Work was spoiled and a few tempers lost besides. In all, it was a "heck of a time," and the questionnaires did not get filed, and the general sentiment was unquestionably opposed to any interference with the private lives of the men.

The "old man" has been paternal in his way, the shop being small enough for any important event to come to his attention, and many homes treasure a wedding gift he gave, a banking account he convinced an apprentice to start, or an insurance on which he made the first payment after the father recovered from an accident, but systematic paternalism does not look good to us.

—B. E. R. RENAUD.

Shall It Be Layoffs or Short Time?

THERE would seem to be no doubt in the case of a general depression of the desirability of "short-time" as against "layoffs." The company profits through its ability to maintain a trained and going organization, while the employees are most certainly better off with "half a loaf" rather than with "no bread."

There is, of course, the undoubted possibility, as Ed says, of the older men objecting to sharing short rations with newcomers. However, in almost any concern of standing the percentage of new men would be comparatively small, so that any laying off of only the new men would help very little in making the necessary reduction in operating expenses.

Since the non-productive and overhead expenses would also be reduced somewhat by a curtailment of working hours, and would remain practically as high as ever, if "laying-off" only was resorted to, the decision seems to be preponderantly in favor of the reduction in hours.

Whether or not a vote of the employees alone would register this decision is of course an open question, but for an official decision, emanating from headquarters, I

THE·NEXT·TOPIC

He Never Asks for a Raise

ADVANCE QUESTION

Bill Hankins never asks for a raise. If it isn't given voluntarily when he feels he's earned it, he quits. What would you do with such a man?

believe that the best ends of all concerned would be achieved by the reduction in hours. —D. C. WRIGHT.

EVERYTHING is in favor of putting it up to the men to vote on the subject. In plants operating under the workmen's representation plan this would be done as a matter of course.

A direct layoff always makes men feel that favoratism has been shown, no matter how carefully the management has considered the subject. It is almost safe to say that the majority would favor the short-time operation. The individual man has no definite assurance that he himself would be retained. Besides, we believe that there is still some of the spirit of brotherly love remaining in the working men. A decision such as this would show that the management also believed in them, and it would have a good effect on the shop morale.

—ALEX. CADDIE, *Canada*.

Too Many Safety Signs

I BELIEVE that too many safety signs may have exactly the opposite effect to that desired. This is especially true if all over the shop we have many detailed and specific "don'ts" with all the vivid descriptions of the disasters that lie in wait for the unthinking violator. These too forceful examples may make mechanics who have been safely performing a given operation for years so nervous of a possible "miscue" that they will literally double-cross themselves into an accident.

In general, I would not favor the permanent type of display, unless it is merely a general slogan, such as "Safety First." It is better to select a given bulletin space, and replace the posters periodically with new ones in order to maintain interest in safety work. If an accident does occur through carelessness, the management can readily spread the true cause through the shops far more effectively by word of mouth than by an official notice in the form of a new sign or bulletin.

—GORDON THRONE.

Giving Men Credit for Good Work

IT DOES not appear that many men favor the idea of having their names on bulletin boards for honorable mention. There is no question about the fact that we all like to hear an encouraging word about a good job, but most men, I believe, would rather have the super say it to them personally, or through the foreman. I dare say that, could a vote be taken of the men, I would be willing to gamble on a 75 per cent vote cast for the dollar in the envelope against a notice on the board.

—WALTER W. YAEGER.

COMPARISONS are proverbially held to be odious. To single out one or two men in the shop for praise, and to advertise their names on the bulletin board, is blatant comparison. Bulletin-board praise is more likely to provoke ridicule than to inspire respect. Praise, like blame, is best when quietly administered. A printed note, issued to the individual, is a different matter, and reserves broadcasting rights to the recipient. But the note would operate none the less effectively, and it would stimulate the man to further effort. For consistent good work, of course, the more tangible financial reward should be forthcoming. —F. C. EDWARDS, *England*.

Co-operating on Theory and Practice

IT IS a very encouraging sign that shop executives in general are beginning to realize the value of subjecting their technical problems to scientific analysis by so-called "theoretical" men. In these days, reductions in cost and improvements in product are being brought about more and more by scientific research into methods and materials, rather than by mechanical ingenuity.

The small concern that cannot afford to maintain its own research laboratory can generally find a fully-equipped laboratory, with an expert staff, available at the nearest engineering college. The professors are, as a rule, anxious to undertake work for manufacturing concerns, in order to keep themselves in touch with the latest methods and the practical problems of the industry. The manufacturer should be just as anxious to make use of the technical and scientific knowledge stored up at the engineering college. —C. S. HAZARD.

Saving the Job of the Careless Workman

IT SEEMS to me that a foreman, or any man higher up, is warranted in doing everything he can to make a good workman out of a poor one. Leaving out any thought about man's duty to his brother man, it seems to me to be sound business to improve the personnel of the factory in any way that it can be done.

No one has ever, as far as my knowledge goes, adequately estimated the cost of firing one man and hiring another, and then teaching him how to do the work. While it probably varies, the cost is high. On the other hand, if the man that you now employ can be developed into a good man, I maintain that he is an infinitely better man for you than you are likely to get by changing.

The influence of the women folk in a family cannot be overestimated as an industrial force. About all that is necessary to get them to work with you in keeping a man up to the mark is to explain the situation to them, and I think it was not only necessary, but highly desirable and effective for the foreman to go to Miller's house and talk it over with his wife and enlist her efforts in the right direction. —DEAN B. GREGG, *Vice President*.

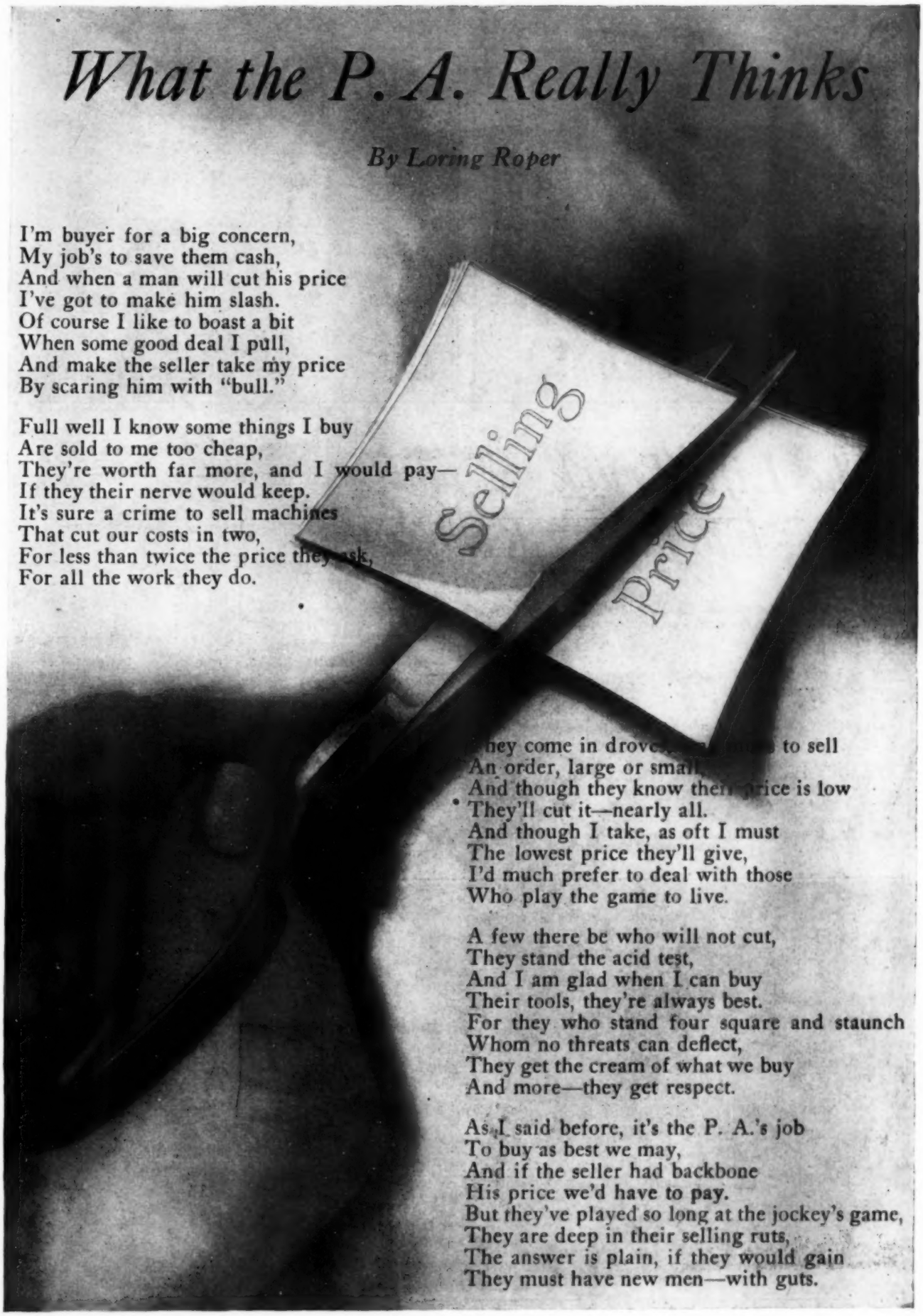
Should the Super Talk to the Men?

THE man who wins is the man who has a smile and a pleasant word for everyone, be he the assistant foreman on the lowest rung of the ladder or the manager on the top. When the superintendent will stop and speak to a man, he shows the man that he is interested in him, and thereby creates a feeling of interest on the part of the man towards the company. He also gets acquainted with his personality, so that he can judge him for further consideration. However, this should not assume the aspect of familiarity, as it may be misconstrued. When he speaks to a man he does not issue instructions, and hence he is not transgressing anyone's authority.

—P. H. PEARSON.

What the P. A. Really Thinks

By Loring Roper



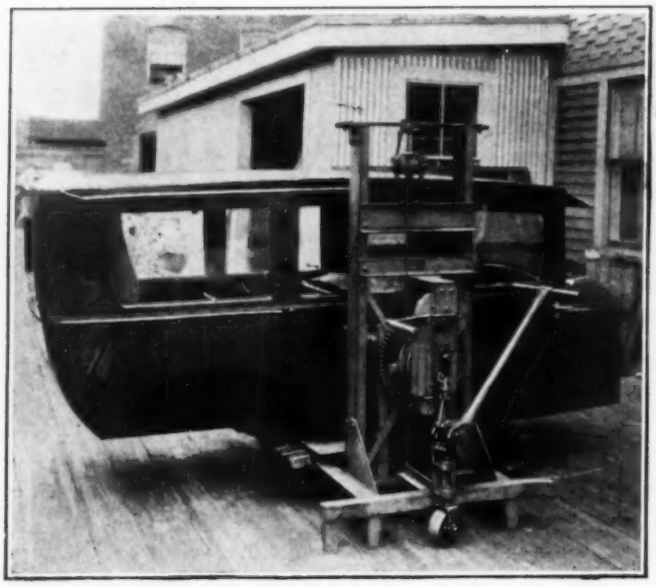
I'm buyer for a big concern,
My job's to save them cash,
And when a man will cut his price
I've got to make him slash.
Of course I like to boast a bit
When some good deal I pull,
And make the seller take my price
By scaring him with "bull."

Full well I know some things I buy
Are sold to me too cheap,
They're worth far more, and I would pay—
If they their nerve would keep.
It's sure a crime to sell machines
That cut our costs in two,
For less than twice the price they ask,
For all the work they do.

hey come in drove to sell
An order, large or smal
And though they know their price is low
They'll cut it—nearly all.
And though I take, as oft I must
The lowest price they'll give,
I'd much prefer to deal with those
Who play the game to live.

A few there be who will not cut,
They stand the acid test,
And I am glad when I can buy
Their tools, they're always best.
For they who stand four square and staunch
Whom no threats can deflect,
They get the cream of what we buy
And more—they get respect.

As I said before, it's the P. A.'s job
To buy as best we may,
And if the seller had backbone
His price we'd have to pay.
But they've played so long at the jockey's game,
They are deep in their selling ruts,
The answer is plain, if they would gain
They must have new men—with guts.



The Lift Truck Earns Its Keep

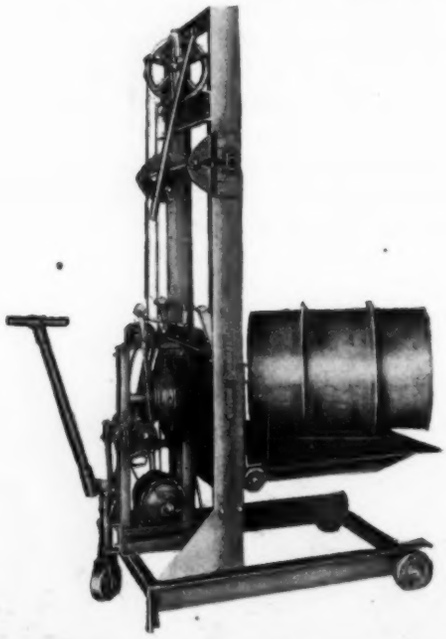
(Upper left) The stacker lifts the automobile body to permit the removal of the castors and supports and later loads it in the freight car

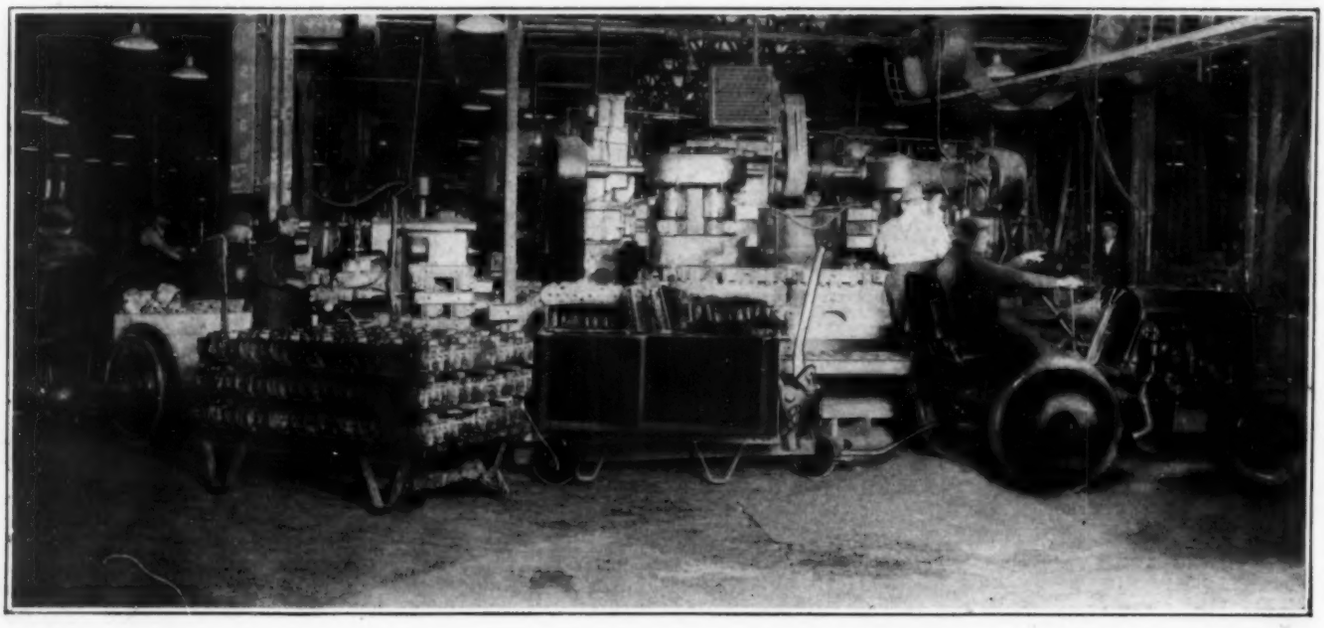
(Upper right) Short, sturdy platforms support boiler sections and similar heavy parts and the lift truck does the rest

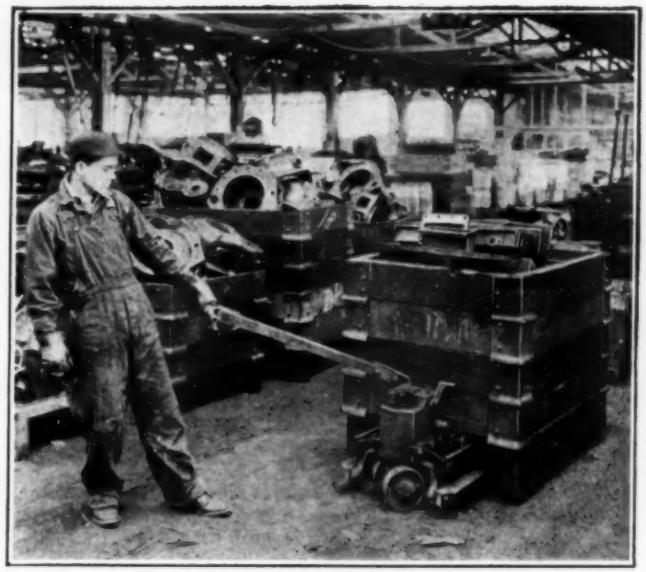
(Right) A motor driven hoist and a turntable on the platform enable this lift truck to do the work of several men

(Below) Two one-car trains of automobile parts passing each other. The lift truck makes a versatile trailer

Photographs from Stuebing-Cowan Company and Lewis-Shepard Company







(Upper left) Nesting tote-boxes, like those shown here, can be variously piled to take care of parts of differing bulk and weight

(Upper right) For handling heavy machines the lift truck is invaluable, particularly where traveling crane service is not available

(Left) The lift truck shown stays with the elevator. It is used to take loaded platforms on and off the elevator

(Below) A train of empty lift truck trailers. The close coupling is economical of floor space

Who Furnishes the Motor?

A RECENT survey conducted by the National Machine Tool Builders' Association to discover who furnishes the motor when a machine tool is purchased showed that in the smaller sizes the builder of the machine is the one. As the power increases the importance of the user as the motor supplier increases steadily. The full story appears in the accompanying table.

Motors for Machine Tools

Hp. of Motor	D.C. —Per	A.C. Cent—	Per Cent Furnished by User	Builder	Dealer
$\frac{1}{8}$ - $\frac{3}{4}$	25	73	8	89	2
1-10	18	80	47	37	15
15-75	16	70	57	30	13

Implications of Mass Production and Distribution

TO PROVE that the business or industrial leader of the future must be internationally minded and not insular minded, Edward A. Filene says that these three implications of mass production and mass distribution must be considered:

1. Mass production is turning out a surplus of goods beyond our present power to consume. Our power to consume will increase with ever-increasing wages, but increasing use of mass production will probably for a long time ahead provide us with a surplus. To maintain our prosperity we shall have to export this surplus, else our producers will be driven to compete so strongly with each other that our prosperity will be destroyed.

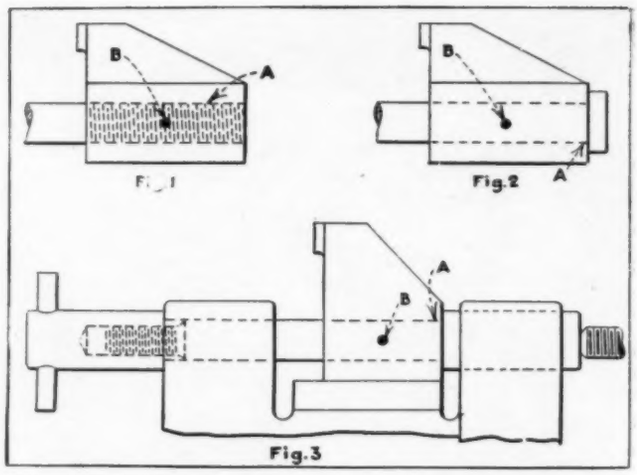
2. But in the end other countries can pay for our surplus only by exporting to us their surpluses. Therefore we cannot continue indefinitely to be prosperous unless the rest of the world adopts our methods of mass production and mass distribution, so that they will have surpluses, made as efficiently as ours, which they can sell to us at a price we can afford to pay.

3. From this it is apparent that for any nation to be prosperous it must have prosperous neighbors.

Design of Hook Bolts—*Discussion*

ON PAGE 1020, Vol. 67, of the *American Machinist*, J. A. Potter has shown two types of hook bolts which have objectionable features, and which do not correspond with bolts that I have usually found in practice. The working end of the bolt shown by him in Fig. 6 is held only by a taper pin, which is too easily sheared off or loosened. If this type of bolt is made as shown here in Figs. 1 and 2, the trouble from breaking will be eliminated. In Fig. 1, as shown, all of the strain comes on the thread, *A*, and the small pin *B*, is simply to prevent rotation of the stem. In Fig. 2, all strain will come on the head *A* and the small pin, *B*, merely prevents the bolt from turning around.

The heavy bolt shown by Mr. Potter in his Fig. 12 also takes all of the strain on a small taper pin. The method of getting away from this which I have usually found in practice is shown in Fig. 3. In this case, all of the strain comes on the shoulder *A*, and the small pin *B* does nothing more than prevent the pin from turning around. Hook bolts of the two styles shown are really miniature vises.



Figs. 1-2—Approved methods of taking up the strain in two-piece hook bolts. Fig. 3—Method of taking the shear off of the pin in a heavy-duty hook bolt

Courtesy in Receiving Visitors *Discussion*

By C. J. Morrison

YOUR editorial published under the above title on page 390, Vol. 68, struck a responsive chord in my mind and invoked memories of reception rooms both good and bad. The thought came to me that those who provide uncomfortable and unattractive reception rooms are unaware of the fact because they never use them.

The reception room that would probably take the prize as the world's worst is provided by a large concern in New York City whose officials are models of courtesy. Once one gets through the agony of the reception room, his troubles are over. This room is an inside one without natural light or ventilation and is stifling in both summer and winter. The only seats provided are some hard wooden benches ranged around the walls. There is nothing to read, which is just as well, as lack of adequate light makes reading impossible anyway. The attendants, which are small boys, seem to change frequently.

A large rubber company in Akron, Ohio, does not even provide a room, with the result that those who are waiting to see some official must stand in a hallway.

In contrast to these, a concern in Cleveland provides a room that seems to be almost ideal. It is a large, bright, airy room furnished with comfortable chairs and tables so that one can either read or write. The latest magazines, technical journals, and newspapers are provided. The attendant is a middle-aged woman of refinement and education with whom it is a pleasure to converse. She is well posted on the activities of the company, and by this knowledge saves much time for callers as well as for officials of the company.

The officials who provide the ideal room are no more courteous than those who are responsible for the other extreme in New York City; but they have evidently given some thought to the matter, and perhaps have tried out their own room. The matter is important, and as a remedy, the suggestion is offered that officials try out their own reception rooms.

Measurement of the Thickness of Involute Gear Teeth

By Allan H. Candee
Gleason Works, Rochester, N. Y.

Calculations for pin measurement of gear teeth with standard pin sizes—Simplification of the calculations by means of standard tables for both external and internal gears

IN THE pin method of measuring the thickness of gear teeth it has occasionally been proposed to use pins of special diameters, selected so that the centers of the pins lie on the pitch circle of the teeth. Then the calculations are very simple. Fig. 4 illustrates this case. Two teeth of an involute gear are shown meshing with the teeth of a corresponding equivalent rack. The pitch circle of the gear is tangent to the pitch line of the rack at the pitch point P. The line of action PM is tangent to the base circle and perpendicular to the tooth profiles at their point of contact Q. The pin is represented by the small circle with center at P, and is tangent to the tooth profiles at Q. In accordance with the properties of gear teeth, the thickness T_R of the equivalent rack tooth on its straight pitch line equals the circular width S of the gear-tooth space. From the diagram it is apparent that the diameter of the pin

$$d = T_R \cos \alpha = \frac{S}{\sec \alpha}$$

In order to keep the center of the pin on the pitch circle of the teeth, it is of course necessary to have a different pin diameter for every different tooth or space thickness and for different pressure angles. This condition is out of the question for any system to be put into general use. Also, pins of this size will usually not extend beyond the tops of the teeth, and with them small pitch gears cannot be measured with ordinary micrometers.

Since in the system here presented the pin diameter is a given standard dimension, the center of the pin generally will not come on the pitch circle, and for a given pitch and number of teeth the dimension between centers of diametrically-opposite pins will vary with the tooth thickness and the pressure angle. The method of calculating the dimension across pins for this general case will now be given.

In Fig. 5 and calculations, the following notations are used:

D_p = pitch diameter
D_b = base diameter
D_m = (measuring) diameter across pin centers
D_M = (measuring) diameter over pins
α = pressure angle corresponding to D_p
α_m = pressure angle corresponding to D_m
d = measuring pin diameter
p = circular pitch, T = tooth thickness, S = width of tooth space } measured on D_p
N = number of teeth

Of course, $p = \frac{\pi D_p}{N}$

and $S = p - T$

Now, a small circle with center at P on the pitch

The second article of the series. The third and last article will appear in an early issue.

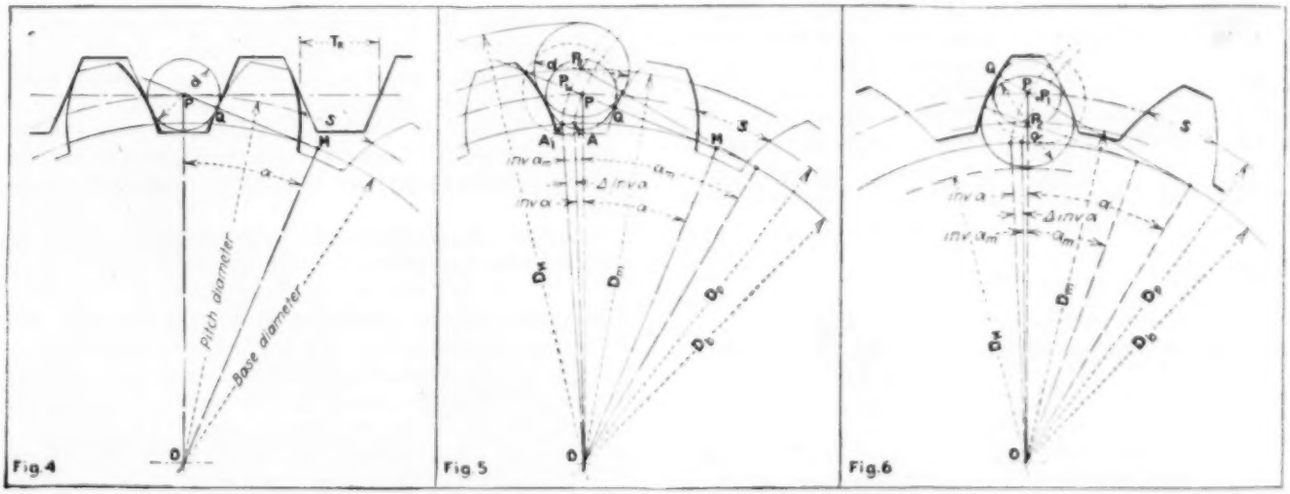


Fig. 4—Special case of a pin selected to lie with its center on the pitch circle of the teeth. Fig. 5—General case of pin measurement of external teeth. Fig. 6—General case of pin measurement of internal teeth

circle and diameter equal to $S \cos \alpha$ is in contact with the profiles on both sides of the tooth space, just as in Fig. 4. Then if the diameter of the circle is increased to d, while the point of contact remains at Q, its center moves along the line of action MP to point P_1, and the distance PP_1 is $\frac{(d - S\cos\alpha)}{2}$. Next, when both circles roll on the tooth profile, the two centers P and P_1 move on the parallel involute curves shown dotted in the diagram, with points of origin A and A_1, respectively. When the center P_1, moving on its involute path, reaches P_2 on the radial line OP through the middle of the tooth space, the position is symmetrical and the circle or pin is tangent to both profiles. At P_2 the pressure angle is α_m as indicated.

It is clear that the circular distance AA_1 equals the straight distance PP_1, as the two points A and A_1 on a string wound around the base circle would come into positions P and P_1 when the string is wound off to the position PM. It is also apparent in the diagram that

$$\text{inv } \alpha_m - \text{inv } \alpha = \text{angle } AOA_1 = \Delta \text{inv } \alpha$$

$$= \frac{2AA_1}{D_b}$$

$$= \frac{d - S\cos\alpha}{D_b}$$

$$= \frac{d - S\cos\alpha}{D_p \cos\alpha}$$

or

$$\Delta \text{inv } \alpha = \frac{\frac{d}{\cos\alpha} - S}{D_p} \qquad (4)$$

Then

$$\text{inv } \alpha_m = \text{inv } \alpha + \Delta \text{inv } \alpha \qquad (5)$$

$\sec \alpha_m$ = value from Table I, corresponding to inv α_m

and

$$D_m = \left(\frac{\sec\alpha_m}{\sec\alpha}\right) D_p \qquad (6)$$

Or, for slide rule calculation,

$$\Delta \sec\alpha = \sec\alpha_m - \sec\alpha$$

$$\Delta_m D = \left(\frac{\Delta \sec\alpha}{\sec\alpha}\right) D_p$$

$$D_m = D_p + \Delta_m D$$

And finally

$$D_M = D_m + d$$

In the above calculations it is assumed that the two pins can be placed diametrically opposite each other, which is the case only when the number of teeth is even. With an odd number of teeth one pin is out of the true diametric position by a distance equal to half the circular pitch and a slight correction must be made in the dimensions D_m and D_M. The triangulation involved is so simple that a detailed explanation is omitted. Let the corrected dimensions be D_{mk} and D_{Mk} respectively and let

$$\Delta_k D = D_m - D_{mk} = D_M - D_{Mk}$$

Then

$$D_{mk} = D_m \cos\left(\frac{90°}{N}\right)$$

and

$$D_{Mk} = D_{mk} + d$$

For greater accuracy in slide rule work,

$$\Delta_k D = D_m \left(1 - \cos\frac{90°}{N}\right)$$

and

$$D_{mk} = D_m - \Delta_k D$$

It is next necessary to consider how to allow for small differences in tooth thickness or in the dimension across the pins. If the tooth profiles were straight, it is obvious that the relationship between a change ΔT in tooth thickness and the corresponding change ΔD_M in dimension over pins would be

$$\Delta T = \Delta D_M \tan \alpha_m$$

Actually the tooth profiles are curved, but for reasonably small changes the above equation gives results sufficiently accurate for practical purposes. Letting

$$k = \tan \alpha_m$$

$$\Delta T = k \Delta D_M$$

or

$$\Delta D_M = \frac{\Delta T}{k}$$

It is repeated that corrections for tooth thickness made in this way are closely approximate only for reasonably small changes, because the curvature of the tooth profile is neglected. For instance, in a gear of 30 teeth, 6 D.P., 14½-deg. pressure angle, $k = 0.328$. If $\Delta D_M = 0.050$ in., the correction in tooth thickness ΔT would be calculated by the above approximate method as 0.0164 in. But due to the curvature of the tooth profile the tooth actually would be 0.0011 in. thicker than indicated by the figures. This approximate method of making corrections for small changes is, therefore, quite satisfactory, for example, in allowing for backlash, but for a case involving long and short addendum teeth, exact calculations should be made instead of trying to correct the measurement applying to teeth of standard addendum.

The sizes of standard pins that have been used in the system to be described are given by the formula

$$d = 1.680 \text{ in.} \div \text{diametral pitch}$$

These pins can be used for teeth of both 14½- and 20-deg. pressure angles. For gears of standard proportions in which the tooth thickness is made one-half of the circular pitch, the pins always project well outside the tops of the teeth for convenient measurement.

When the tooth thickness at the standard pitch diameter is specified, calculations can be made in the form illustrated by the following typical example:

Number of teeth N 31

Table II—Standard Pin Diameters and Constants

Diam. Pitch P	Standard Pin Diam. d Inches	Standard Tooth Thickness T Inches	$\alpha = 14\frac{1}{2}°$ $\frac{d}{\cos\alpha}$	$\frac{d}{\cos\alpha} - T$	$\alpha = 20°$ $\frac{d}{\cos\alpha}$	$\frac{d}{\cos\alpha} - T$
1	1.680	1.5708	1.7353	0.1645	1.7878	0.2170
2	0.840	0.7854	0.8676	0.0822	0.8939	0.1085
2½	0.672	0.6283	0.6942	0.0658	0.7151	0.0868
3	0.560	0.5236	0.5784	0.0548	0.5959	0.0723
3½	0.480	0.4488	0.4958	0.0470	0.5108	0.0620
4	0.420	0.3927	0.4338	0.0411	0.4469	0.0542
5	0.336	0.3142	0.3471	0.0329	0.3576	0.0434
6	0.280	0.2618	0.2892	0.0274	0.2980	0.0362
7	0.240	0.2244	0.2479	0.0235	0.2554	0.0310
8	0.210	0.1963	0.2169	0.0206	0.2235	0.0271
9	0.1867	0.1745	0.1928	0.0183	0.1986	0.0241
10	0.168	0.1571	0.1735	0.0164	0.1788	0.0217
12	0.140	0.1309	0.1446	0.0137	0.1490	0.0181
16	0.105	0.0982	0.1084	0.0103	0.1117	0.0136
20	0.084	0.0785	0.0868	0.0082	0.0894	0.0109
24	0.070	0.0654	0.0723	0.0069	0.0745	0.0090

For Standard Pins and Gears

Pin Diameter $d = \frac{1.680}{P}$ $\qquad$ $\text{inv } \alpha = \frac{\frac{d}{\cos\alpha} - T}{N}$

Tooth Thickness $T = \frac{3.1416}{2P}$

Diametral pitch	P	8
Pitch diameter	$D_p = \frac{N}{P}$	3.875 in.
Pressure angle	α	20 deg.
Tooth thickness	T	0.194 in.
Pin diameter	$d = 1.680 \div P$	0.210 in.
Circular pitch	$p = 3.1416 \div P$	0.3927 in.
Width of tooth space	$S = p - T$	0.1987 in.
	$\cos \alpha$	0.93969 in.
	$\frac{d}{\cos \alpha}$	0.2235 in.
	$\frac{d}{\cos \alpha} - S$	0.0248 in.
$\Delta \text{ inv } \alpha =$	$\frac{\frac{d}{\cos \alpha} - S}{D_p}$	0.00640 in.
From Table I	$\text{inv } \alpha = \tan \alpha - \alpha$	0.01490 in.
	$\text{inv } \alpha_m = \text{inv } \alpha + \Delta \text{ inv } \alpha$	0.02130 in.
From Table I	$\sec \alpha_m =$	1.0818 in.
	$\sec \alpha =$	1.0642 in.
	$\Delta \sec \alpha = \sec \alpha_m - \sec \alpha$	0.0176 in.
	$\Delta_m D = \frac{\Delta \sec \alpha}{\sec \alpha} D_p$	0.064 in.
Diameter to pin centers for even number of teeth	$D_m = D_p + \Delta_m D$	3.939 in.
	$A_k = \frac{90^\circ}{N}$	2°54′
	$\cos A_k$	0.9987 in.
Correction for odd number of teeth	$\Delta_k D = (1 - \cos A_k) D_m$	0.0005 in.
Diameter to pin centers for odd number of teeth	$D_{mk} = D_m - \Delta_k D$	3.934 in.
Diameter over pins	$D_{Mk} = D_{mk} + d$	4.144 in.

Suppose next that when measuring a gear like the above, the diameter over pins is found to be 4.151 in. instead of 4.144 in. Then the actual tooth thickness is obtained as follows:

Thickness factor	$k = \tan \alpha$ (Table I)	0.413 in.
Diameter over pins	actual D_{M1}	4.151 in.
	specified D_M	4.144 in.
Diameter change	$\Delta D_M = D_{M1} = D_M$	0.007 in.
Thickness change	$\Delta T = k \Delta D_M$	0.003 in.
Tooth thickness	specified T	0.194 in.
	actual $T_1 = T + \Delta T$	0.197 in.

In addition to Table I for involute α, already referred to, the following tables accompany this article:

Standard pin diameters and constants are given in Table II.

Dimensions across pins and thickness factor k for standard involute gears of 1 D.P. are given in Tables III to VI, thus:

External gears, 14½-deg. pressure angle Table III.
External gears, 20-deg. pressure angle Table IV.
Internal gears, 14½-deg. pressure angle Table V.
Internal gears, 20-deg. pressure angle Table VI.

For any size of teeth other than 1 D.P., the dimensions across pins are obtained by dividing the values in the tables by the diametral pitch. The factor k, however, remains constant for all pitches.

To illustrate the use of the tables, take the gear for which calculations were made above. From Table II for 8 D.P.,

$$d = 0.210 \text{ in.}$$
$$T = 0.1963 \text{ in.}$$

From Table IV for $N = 31$ teeth

$$D_M = 33.200 \text{ in. for 1 D.P.}$$
$$k = 0.417$$

For 8 D.P. $D_M = 33.200 \div 8 = 4.150$ in.

Then, if $T_1 = 0.194$ in. (as specified)

$$\Delta_1 T = T - T_1 = 0.0023 \text{ in.}$$

$$\Delta_1 D = \frac{\Delta_1 T}{k} = 0.0055 \text{ in.}$$

Table III—Dimensions Over Pins and Thickness Factors for External Involute Spur Gears, 1 D. P. of 14½-Deg. Pressure Angle

No. of Teeth N	Dimension Over Pins D_M	Thickness Factor k	No. of Teeth N	Dimension Over Pins D_M	Thickness Factor k
11	13.056	0.407	66	68.278	0.293
12	14.185	0.395	67	69.259	0.293
13	15.090	0.386	68	70.279	0.293
14	16.197	0.379	69	71.261	0.292
15	17.116	0.374	70	72.279	0.292
16	18.206	0.369	71	73.263	0.291
17	19.136	0.365	72	74.280	0.291
18	20.214	0.361	73	75.264	0.291
19	21.152	0.357	74	76.281	0.290
20	22.221	0.354	75	77.265	0.290
21	23.165	0.351	76	78.282	0.290
22	24.227	0.347	77	79.266	0.289
23	25.176	0.344	78	80.283	0.289
24	26.232	0.341	79	81.268	0.288
25	27.185	0.339	80	82.283	0.288
26	28.237	0.337	81	83.269	0.288
27	29.193	0.335	82	84.284	0.287
28	30.241	0.332	83	85.269	0.287
29	31.199	0.330	84	86.285	0.287
30	32.245	0.328	85	87.270	0.287
31	33.206	0.326	86	88.285	0.286
32	34.249	0.325	87	89.271	0.286
33	35.212	0.323	88	90.286	0.286
34	36.252	0.322	89	91.272	0.285
35	37.217	0.320	90	92.286	0.285
36	38.255	0.319	91	93.273	0.285
37	39.222	0.317	92	94.287	0.285
38	40.257	0.316	93	95.273	0.284
39	41.226	0.315	94	96.287	0.284
40	42.259	0.313	95	97.274	0.284
41	43.229	0.312	96	98.287	0.284
42	44.261	0.311	97	99.275	0.283
43	45.233	0.310	98	100.288	0.283
44	46.263	0.309	99	101.276	46.263
45	47.236	0.308	100	102.289	0.283
46	48.265	0.307	101	103.277	0.283
47	49.239	0.306	102	104.290	0.282
48	50.266	0.305	103	105.278	0.282
49	51.241	0.304	104	106.290	0.282
50	52.268	0.303	105	107.279	0.282
51	53.244	0.303	106	108.291	0.281
52	54.269	0.302	107	109.279	0.281
53	55.246	0.301	108	110.291	0.281
54	56.271	0.300	109	111.280	0.281
55	57.248	0.300	110	112.291	0.281
56	58.272	0.299	111	113.280	0.281
57	59.250	0.298	112	114.292	0.280
58	60.273	0.298	113	115.281	0.280
59	61.252	0.297	114	116.292	0.280
60	62.274	0.297	115	117.281	0.280
61	63.254	0.296	116	118.292	0.280
62	64.275	0.295	117	119.282	0.280
63	65.256	0.295	118	120.293	0.279
64	66.276	0.294	119	121.282	0.279
65	67.258	0.294	120	122.293	0.279

Table IV—Dimensions Over Pins and Thickness Factors for External Involute Spur Gears, 1 D. P., of 20-Deg. Pressure Angle

No of Teeth N	Dimension Over Pins D_M	Thickness Factor k	No. of Teeth N	Dimension Over Pins D_M	Thickness Factor k
11	13.074	0.491	66	68.258	0.390
12	14.201	0.482	67	69.240	0.390
13	15.105	0.474	68	70.258	0.390
14	16.209	0.468	69	71.241	0.389
15	17.127	0.462	70	72.259	0.389
16	18.215	0.457	71	73.242	0.389
17	19.143	0.453	72	74.259	0.388
18	20.220	0.449	73	75.242	0.388
19	21.156	0.446	74	76.260	0.388
20	22.225	0.442	75	77.243	0.387
21	23.167	0.439	76	78.260	0.387
22	24.229	0.436	77	79.244	0.387
23	25.176	0.433	78	80.261	0.387
24	26.232	0.430	79	81.245	0.386
25	27.183	0.428	80	82.261	0.386
26	28.235	0.426	81	83.246	0.386
27	29.190	0.424	82	84.261	0.385
28	30.237	0.422	83	85.247	0.385
29	31.195	0.420	84	86.262	0.385
30	32.239	0.418	85	87.247	0.385
31	33.200	0.417	86	88.262	0.384
32	34.241	0.415	87	89.248	0.384
33	35.204	0.414	88	90.262	0.384
34	36.243	0.413	89	91.248	0.384
35	37.208	0.412	90	92.263	0.383
36	38.245	0.410	91	93.249	0.383
37	39.212	0.409	92	94.263	0.383
38	40.246	0.408	93	95.250	0.383
39	41.215	0.407	94	96.263	0.383
40	42.248	0.406	95	97.250	0.382
41	43.217	0.405	96	98.263	0.382
42	44.249	0.404	97	99.251	0.382
43	45.220	0.403	98	100.264	0.382
44	46.250	0.403	99	101.251	0.382
45	47.222	0.402	100	102.264	0.382
46	48.251	0.401	101	103.252	0.381
47	49.225	0.400	102	104.264	0.381
48	50.252	0.400	103	105.252	0.381
49	51.227	0.399	104	106.264	0.381
50	52.253	0.398	105	107.252	0.381
51	53.229	0.398	106	108.265	0.381
52	54.253	0.397	107	109.253	0.381
53	55.231	0.396	108	110.265	0.380
54	56.254	0.396	109	111.254	0.380
55	57.232	0.395	110	112.265	0.380
56	58.255	0.395	111	113.254	0.380
57	59.234	0.394	112	114.265	0.380
58	60.256	0.394	113	115.254	0.380
59	61.235	0.393	114	116.265	0.380
60	62.256	0.393	115	117.254	0.379
61	63.236	0.392	116	118.265	0.379
62	64.257	0.392	117	119.254	0.379
63	65.237	0.392	118	120.265	0.379
64	66.257	0.391	119	121.255	0.379
65	67.239	0.391	120	122.265	0.379

$$D_{M1} = D_M - \Delta_1 D = 4.1445 \text{ in.}$$

This checks almost exactly with the dimension over pins obtained by direct calculation.

The pin measurement dimension and thickness factor k are also very useful when hobbing gears, in estimating the increase in cutting depth necessary to give the desired tooth thickness, after a first cut has been taken and the teeth are almost to size. For changes in dimension over pins

$$\Delta T = k \Delta D$$

For changes in the cutting depth of hob, if

$\Delta_H D$ = change in root diameter

it is easily seen that

$$\Delta T = \Delta_H D \tan \alpha$$

It follows that

$$\Delta_H D = \left(\frac{k}{\tan \alpha}\right) \Delta D$$

Suppose that after the first hobbing cut, the dimension over the pins is

$$D_{M1} = 4.158 \text{ in.}$$

when

$$D_M = 4.144 \text{ in.}$$
$$\tan \alpha = 0.364 \text{ in.}$$
$$k = 0.417 \text{ in.}$$

Then

$$\Delta D = 4.158 - 4.144 = 0.014 \text{ in.}$$

and

$$\Delta_H D = (0.417 \div 0.364) \times 0.014 = 0.016 \text{ in.}$$

The hob therefore should be set to cut $(\Delta_H D \div 2)$ = 0.008 in. deeper to give the specified tooth thickness.

Up to this point only external spur gears have been considered in the derivation of formulas and in the

Table V—Dimensions Between Pins and Thickness Factors for Internal Involute Spur Gears, 1 D. P., of 14½-Deg. Pressure Angle

No. of Teeth N	Dimension Between Pins D_M	Thickness Factor k	No. of Teeth N	Dimension Between Pins D_M	Thickness Factor k
31	28.411	0.088	76	73.638	0.218
32	29.475	0.107	77	74.623	0.219
33	30.456	0.119	78	75.640	0.220
34	31.509	0.129	79	76.624	0.220
35	32.486	0.137	80	77.640	0.221
36	33.530	0.144	81	78.625	0.222
37	34.507	0.150	82	79.640	0.222
38	35.547	0.155	83	80.626	0.223
39	36.522	0.159	84	81.641	0.223
40	37.560	0.163	85	82.627	0.224
41	38.535	0.167	86	83.642	0.224
42	39.569	0.170	87	84.628	0.225
43	40.545	0.173	88	85.644	0.225
44	41.577	0.176	89	86.629	0.225
45	42.554	0.179	90	87.645	0.226
46	43.585	0.182	91	88.631	0.226
47	44.563	0.184	92	89.646	0.227
48	45.592	0.186	93	90.633	0.227
49	46.570	0.188	94	91.647	0.227
50	47.598	0.190	95	92.634	0.228
51	48.576	0.192	96	93.647	0.228
52	49.602	0.194	97	94.635	0.229
53	50.581	0.195	98	95.648	0.229
54	51.606	0.197	99	96.636	0.229
55	52.586	0.198	100	97.649	0.230
56	53.610	0.200	101	98.637	0.230
57	54.590	0.201	102	99.650	0.230
58	55.614	0.202	103	100.638	0.230
59	56.595	0.204	104	101.650	0.231
60	57.617	0.205	105	102.638	0.231
61	58.599	0.206	106	103.650	0.231
62	59.621	0.207	107	104.639	0.231
63	60.604	0.208	108	105.651	0.232
64	61.625	0.209	109	106.640	0.232
65	62.607	0.210	110	107.651	0.232
66	63.628	0.211	111	108.640	0.233
67	64.611	0.212	112	109.652	0.233
68	65.631	0.213	113	110.641	0.233
69	66.614	0.213	114	111.652	0.233
70	67.633	0.214	115	112.642	0.233
71	68.617	0.215	116	113.653	0.234
72	69.635	0.216	117	114.643	0.234
73	70.619	0.216	118	115.654	0.234
74	71.636	0.217	119	116.644	0.234
75	72.621	0.218	120	117.655	0.234

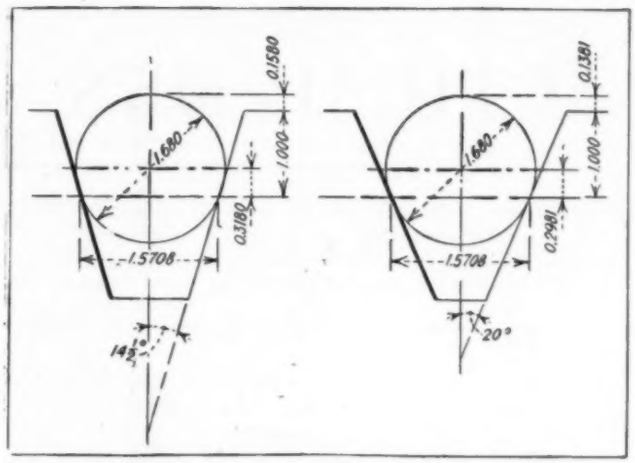


Fig. 7—Check on tooth thickness of involute rack with a standard pin

Table VI—Dimensions Between Pins and Thickness Factors for Internal Involute Spur Gears, 1 D. P., of 20-Deg. Pressure Angle

No. of Teeth N	Dimension Between Pins D_M	Thickness Factor k	No. of Teeth N	Dimension Between Pins D_M	Thickness Factor k
31	28.628	0.292	76	73.705	0.338
32	29.669	0.294	77	74.689	0.338
33	30.634	0.297	78	75.705	0.339
34	31.673	0.299	79	76.690	0.339
35	32.640	0.301	80	77.706	0.339
36	33.677	0.303	81	78.691	0.340
37	34.646	0.305	82	79.706	0.340
38	35.680	0.307	83	80.692	0.340
39	36.650	0.309	84	81.707	0.340
40	37.683	0.311	85	82.693	0.341
41	38.655	0.312	86	83.707	0.341
42	39.686	0.314	87	84.693	0.341
43	40.658	0.315	88	85.708	0.342
44	41.688	0.316	89	86.69	0.342
45	42.661	0.318	90	87.708	0.342
46	43.689	0.319	91	88.695	0.343
47	44.664	0.320	92	89.708	0.343
48	45.691	0.321	93	90.695	0.343
49	46.667	0.322	94	91.709	0.343
50	47.693	0.323	95	92.696	0.344
51	48.669	0.324	96	93.709	0.344
52	49.694	0.325	97	94.697	0.344
53	50.671	0.325	98	95.709	0.344
54	51.695	0.326	99	96.697	0.345
55	52.674	0.327	100	97.710	0.345
56	53.696	0.328	101	98.698	0.345
57	54.676	0.328	102	99.710	0.345
58	55.698	0.329	103	100.698	0.345
59	56.677	0.330	104	101.710	0.345
60	57.699	0.330	105	102.699	0.346
61	58.679	0.331	106	103.711	0.346
62	59.700	0.331	107	104.699	0.346
63	60.681	0.332	108	105.711	0.346
64	61.700	0.332	109	106.700	0.346
65	62.682	0.333	110	107.711	0.346
66	63.701	0.334	111	103.700	0.347
67	64.683	0.334	112	109.711	0.347
68	65.702	0.334	113	110.700	0.347
69	66.685	0.335	114	111.711	0.347
70	67.703	0.335	115	112.701	0.347
71	68.686	0.336	116	113.712	0.347
72	69.704	0.336	117	114.701	0.348
73	70.687	0.337	118	115.712	0.348
74	71.704	0.337	119	116.702	0.348
75	72.688	0.337	120	117.712	0.348

calculations. In the case of internal spur gears certain changes occur in the positive (+) and negative (—) signs. Fig. 6 is a diagram for internal teeth where the conditions are analogous to Fig. 5 for external teeth.

The fundamental difference between the two cases is indicated by the formulas:

External Gears, Fig. 5 $\quad \text{inv}\,\alpha_m = \text{inv}\,\alpha + \Delta\,\text{inv}\,\alpha \qquad (5)$

Internal Gears, Fig. 6 $\quad \text{inv}\,\alpha_m = \text{inv}\,\alpha - \Delta\,\text{inv}\,\alpha \qquad (5a)$

Of course, the relationship

$$D_m = \frac{\sec \alpha_m}{\sec \alpha} D_p \qquad (6)$$

holds good for both cases, but it should be noted that for internal gears of usual dimensions α_m, $\sec \alpha_m$, and D_m are all smaller than α, $\sec \alpha$, and D_p, respectively.

It may sometimes be desired to use standard pins as given in Table II to check tooth thickness of involute racks. In Fig. 7 the dimensions for standard 1 D.P. racks are shown.

Who Pays the Cost of Price Cutting?
Discussion

By Harry Kaufman

IN THE very able article under the above title in Volume 68, No. 8, of the *American Machinist*, Earl Whitehorne certainly puts the onus of the present situation where it belongs—on secret bids used as unfair clubs over the heads of the sellers. But, to make the lifting of the ban on open competitive bids fully effective, standardized specifications should be prepared by the purchasers so that all bids submitted are really comparable. As far as practicable, performance should be definitely written into the specifications.

Without definite specifications, the burden of proving that the lowest bid is really an inferior product which will not stand up or produce the product that the higher bidder guarantees, falls upon the higher bidder. To knock a competitor's product is the lowest form of salesmanship, and it is just as unethical for the buyer to force the seller into this position, as it is to force him to cut prices. With definite specifications, the inferior product is either forced out of competition, or the bid is made with reservations. If an inferior producer deliberately bids without reservation, common knowledge of the foremen and shop men will soon convince an over zealous purchasing agent that he is about to have something pulled over on him. There is, of course, the other side of the picture which may also be evaded by definite, well though out specifications, and that is in getting a product which is too elaborate and has too many unnecessary features for the particular purpose intended. These specifications do take time and money, but it is effort well expended for all concerned, and will form the practical foundation on which to build Mr. Whitehorne's new structure of fair business dealing.

"One of the tragedies of unemployment is the almost total lack of public interest in the problem, except during industrial crises when attention is usually concentrated upon measures for emergency relief."—Report of Economic Advisory Committee to the President's Conference on Unemployment.

Cleaning lamp globes at frequent intervals will greatly increase light received from them.

IDEAS · FROM · PRACTICAL · MEN

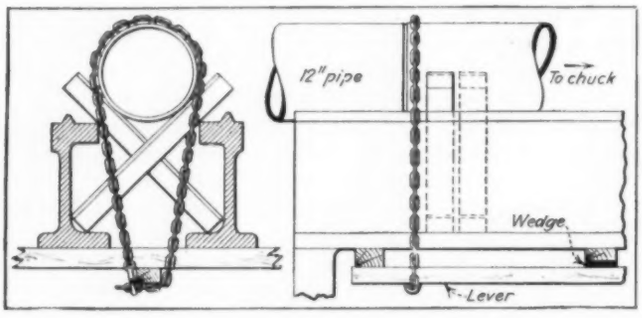
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

An Improvised Steadyrest

By H. B. McDermid

Recently we had to cut some 12 in. pipe into shorter lengths, and the job was given to an old-time machinist. The only available lathe was a short one of 20-in. swing, the steadyrest for which was too small to take the pipe.

The old timer blocked up the pipe on the lathe bed, to the height of the centers and chucked one end. Then he hunted up a pair of timbers of the right size to be slipped into the lathe bed and form a sort of saw-buck so as to hold the pipe in position, yet allow it to rotate. The sides



An improvised steadyrest

of the timbers next to the pipe were faced with iron to reduce friction.

An ordinary chain was passed around the pipe and around a lever, the fulcrum of which was a piece of timber placed across the bottom of the lathe bed. With a few wedges to take up the slack of the chain, the arrangement made an improvised steadyrest. The illustration shows the device. Some care was required in making the proper adjustments, but the pipe was cut in fairly good time and the ends were reasonably smooth.

Our only alternative would have been to cut the pipe with an acetylene torch, making the cut comparatively rough and necessitating the ends being smoothed with a file or a portable grinder.

Spacer for Section Lining—*Discussion*

By John Homewood

While in no way discrediting the merits of the suggestion put forth in the article by Frank D. Smith, Jr., under the title given above, on page 665, Vol. 67, of the *American Machinist*, I feel that too much "instrumentality" is not conducive to the best results. Drawing section lines is a time-taking job, and it behooves the draftsman to use the method that will not only cut down the time but increase his skill. The training given the eye when making section lines without the assistance of any instrument, is very good. After sufficient practice the man can draw lines remarkably uniform in spacing.

Drawings for publication should be of the very best and the time element is not so "heartless" as while "under fire" while on the job. I can see no objection to recourse to methods wherein instruments insure quality, for such work.

The beginner, or student in drafting, should not be allowed to use an instrument that will in any way interfere with his manipulative development. It is as necessary for the beginner to learn to space evenly as it is for him to learn to print. Practice in either case is indispensable and in the majority of cases constitutes a hard road. Let us not lean too much on the crutches for fear that we might lose the use of our legs.

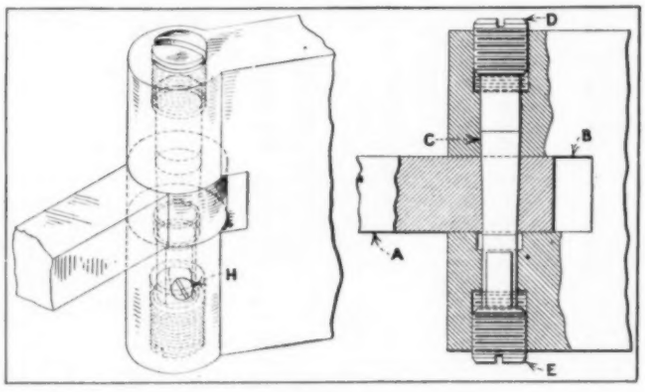
Precision Take-Up Pivot Bearing

By Henry Simon

Jena, Germany

The pivot bearing illustrated is based on the same general principle as the taper spindle bearing used in machine tools, but so far as the writer knows, it is novel in its present application, as well as in the details of construction.

The bearing was designed for a precision mechanism where other types were considered unsatisfactory because



A pivot bearing that can be adjusted with unusual accuracy

of their inability to preserve exact concentricity of all parts under all conditions of use and wear. The lever end *A* is a snug turning fit in the slot *B* of the fork. The pivot stud *C* is a light force fit in its seats, along which it is adjustable by screws *D* and *E*. The screw *H* holds it against rotation.

The bearing combines the take-up ability of centers, with the full surface support afforded by a straight bear-

ing, and adds thereto an extraordinary nicety of adjustment. With the taper $\frac{1}{4}$ in. per ft. or 0.021 in. per in. $\frac{1}{16}$ turn of the screws will vary the diameter $\frac{0.021}{28 \times 16}$ = about 0.00005 in. Provided the parts are made with good care and particularly that slot *B* gives no more than the necessary 0.00025-in. side play to the lever, the amount of this theoretical adjustment is very nearly realized in practice.

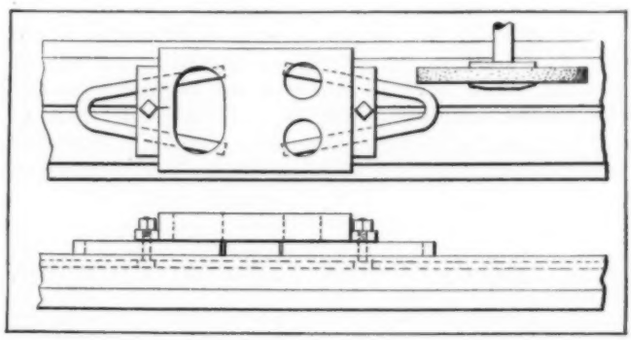
The only things in making that require some thought, are to get the slot *B* accurately at a right angle to the hole through the fork, and likewise to get the hole through the lever end accurately at a right angle to its side surfaces. Any difficulty in regard to these points can be avoided by making, in each case, the hole first and working from it. By forming centers in the ends of the hole in the fork before it is counterbored for the screws, the slot can easily be milled and ground while the piece is held on centers. Similarly, by finishing the hole through the lever, it can be mounted on a taper teat, one cheek ground, and the other made parallel to it later on the surface grinder.

An Improvised Magnetic Chuck

By Everett J. Wheeler

In our toolroom, one of the jobs was to keep in repair the dies used in the presses in the production department. We had a surface grinder but no magnetic chuck, so that the dies had to be clamped to the machine table for grinding.

I picked up a couple of magnets that had been a part of the magneto of a discarded flivver. After grinding



Magnetic chuck made from parts of a flivver

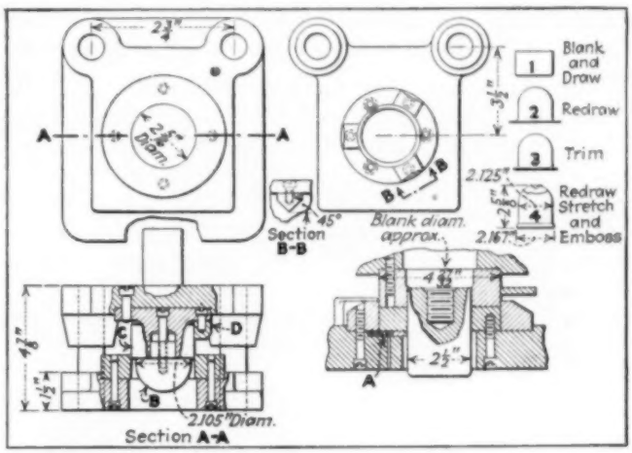
the sides of the magnets parallel they were strapped to the grinder table, as shown in the sketch. While the magnetism was strong enough to resist the thrust of the feed, the end thrust had to be taken care of by using one of the clamps as an end stop.

Dies for Drawing and Trimming Brass Shells

By George H. Feltner

Float shells for Stewart-Warner vacuum tanks, made of 0.01x5$\frac{1}{8}$-in. soft, deep-drawing brass, require for their construction four press operations, namely: blanking and drawing, first redrawing, trimming, and second redrawing and embossing. At the right, in the illustration, are shown the outlines of the work as performed by each set of press tools. An annealing is required between the first and second operations. The operation of blanking and drawing is performed in a double-acting press, and the other operations are handled in single-acting presses.

In trimming shells it is sometimes difficult to get rid of the scrap, although in the die illustrated this problem has been taken care of with the result that the scrap is



Die for trimming a drawn shell. The scrap trimmed from the shell is cut into three pieces and is blown from the die by air

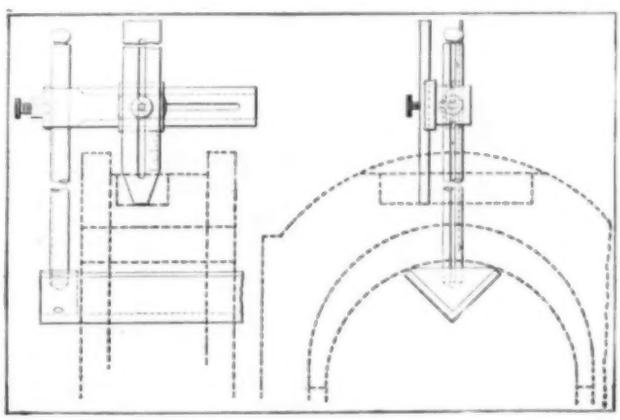
ejected automatically. On the downward stroke the pilot *B* centers the work, then the punch *C* trims the outer edge. The pilot is so made that the shell falls from it after being trimmed, and passes through the bolster plate of the press. Three cutters as at *D* are attached to the punch holder to cut the scrap into three pieces, after which they are blown from the die by air.

Gage for Spring Seats of Driving Boxes

By George Bexton
Stratford, Canada

Unless the spring seats on all the driving boxes of a locomotive are of equal height from the journals, undue strain is put upon the springs and is liable to cause their breakage.

The gage shown in the illustration was designed to determine the height of the spring seat in each box, so that if any variation existed in the set the seats could all be brought to the same height, either by machining the high ones or by building up the low ones by the welding



Gage for spring seats of driving boxes

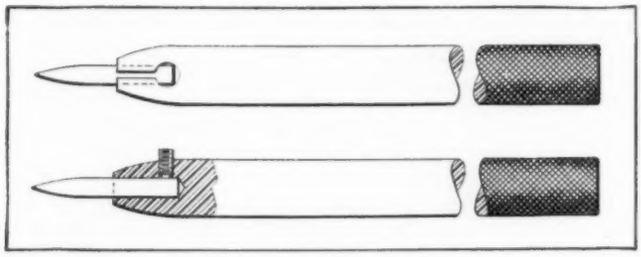
process. The driving box is indicated on the drawing by heavy dotted lines.

The base of the gage is angular, so as to take a bearing on the inside of the crown brass. The cross-beam slides up and down on a post attached to the base, and can be locked in any position by a thumbscrew. The sliding gage is graduated and is held in place by the tension of a flat spring, so that in adjusting it no screws have to be manipulated. By use of the gage the fitter can take a quick and accurate reading of the height of the spring seats.

A Scriber With Renewable Points

By Wm. Sponsler

A scriber with renewable points can be made as shown in the sketch, the points being phonograph needles. Holders can be made in either of the styles shown. The one at the top holds the needle by friction, while in the



Phonograph needles as scriber points

one at the bottom the needle is held by a headless set-screw.

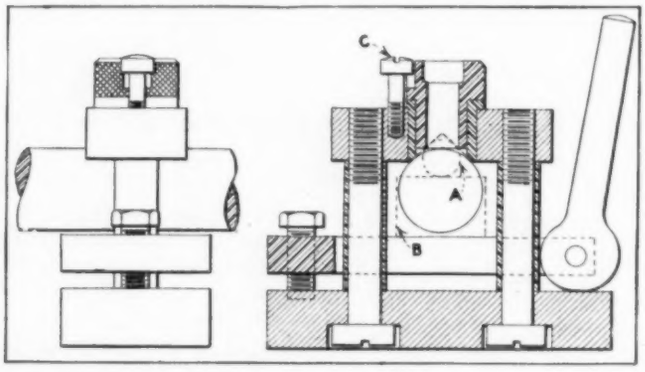
The same idea can be applied to beam compasses and dividers by attaching a small clamp to the legs for holding the needles.

A Jig for Drilling Cross-Holes in Round Stock

By W. L. Romick

The jig illustrated herewith was designed by the class in Jig and Fixture Design at the Kansas State Agricultural College. It can be used for drilling holes of various sizes in bars having a wide range in diameters. The V-block for centering the bars is in the bushing plate, and the bushing, being a slip fit in the plate, can slide up or down to accommodate bars of different diameters. This arrangement permits the use of plain blocks instead of the usual V-blocks for supporting different sizes of bars.

As shown in the sketch, when a small bar as at *A* is to be drilled, it is supported on the plain block *B*. Clamping is by means of the cam lever at the right. Adjustment so that the cam lever will lock bars of different diameters, is made by the screw at the left. The fillister-head screw *C* prevents the bushing from rotating.

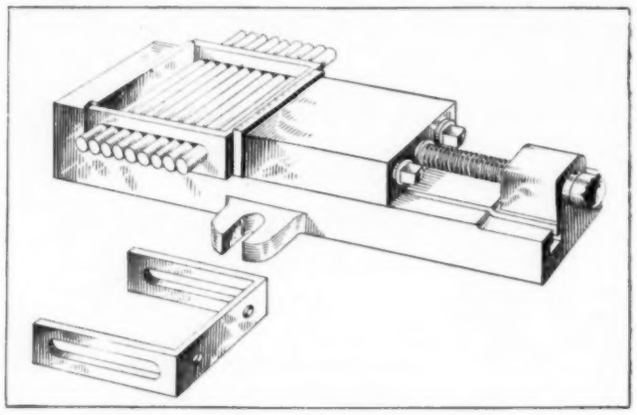


Jig for drilling cross-holes in round stock

Vise Jaw for Holding Bars

By H. Moore

A practical way of holding as many bars as a vise will take side-by-side, is to use a special jaw similar to the one illustrated. The jaw is simple and easy to make



Jaw for holding bars in a machine vise

and will repay the time spent if it is used for sawing off bars or milling the ends in gangs.

Both ends of the jaw are bent at right angles to the vise jaws and are slotted to take the bars. It will be seen that the number of bars that can be held is limited only by the capacity of the vise and that with a jaw of this type the bars need not be exactly alike in diameter. Bars of any symmetrical shape can be held with equal facility.

Making High-Speed Circular Forming-Tools—*Discussion*

By Charles Kugler

The article by H. J. Gustav Kopsch, under the title given above, and published on page 183, Vol. 68, of the *American Machinist*, interested me very much. I believe the method outlined by Mr. Kopsch is a very good one for shops that will go to the expense of grinding circular forming-tools, all over. However, there are some shops—and large ones at that—that will not permit such an expensive method.

In cases where I have to make circular forming-tools without grinding them all over, I always put a mirror polish on them after they have been turned. They are hardened in the usual manner and then polished again. I find that they have very little scale on them. Apparantly the high polish given before hardening, prevents the scale from forming to a great extent.

The tools are then gashed by an elastic wheel. If the wheel is kept in condition to cut freely, there is no danger of burning the steel.

Activity in the Metal Working Industries

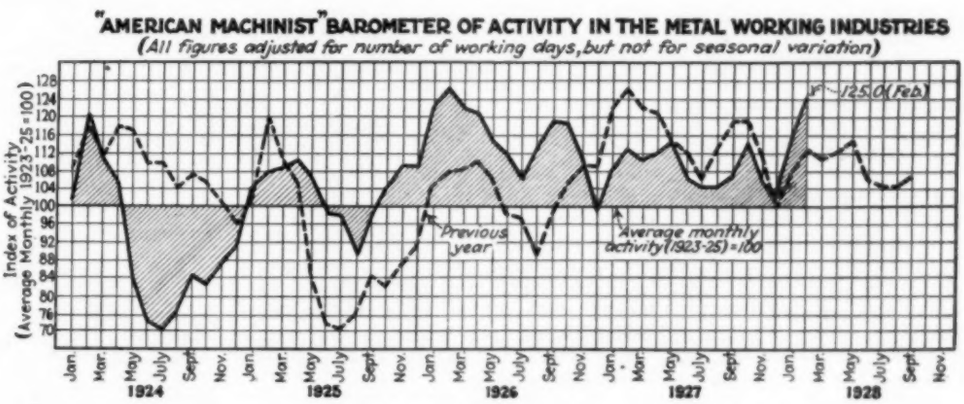
Increased Activity During February

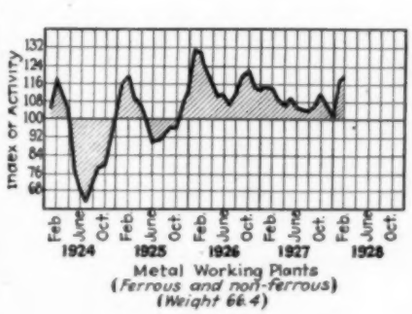
That a materially increased rate of operations was witnessed in the metal-working plants of the nation during February is indicated by preliminary data received upon the consumption of electrical energy by a large number of these plants. The upward trend in operations that started in January appears to have been continued through February, the February rate of activity being about 9 per cent over January and 21 per cent over December, after corrections are made for the appropriate number of working days in the two months. The returns indicate operations materially over those of February last year, but slightly under February of 1926.

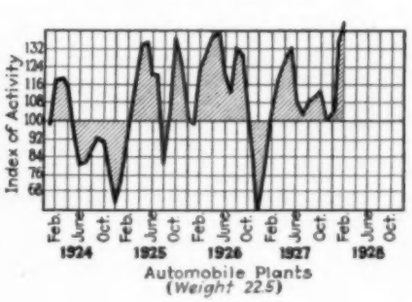
The ferrous and non-ferrous metal-working plants reported February activity about 1.5 per cent over January and 18 per cent over December. The rate of operations in these plants during February, however, was still about 8 per cent under that recorded during February, 1926, although slightly above February of last year. All branches of the automobile manufacturing industry appear to be operating at record rates. The February rate of automobile production was above that of any previous month, and the manufacture of replacement parts for the cars already in use was between 25 and 30 per cent over that of a year ago. Activities in the railroad repair shops also recorded an upward trend, the February activities being about 6.6 per cent above January and 1.5 per cent over December.

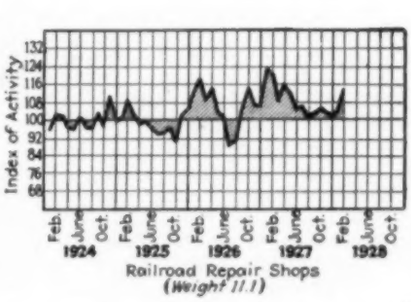
Activities in the railroad repair shops also recorded an upward trend, the February activities being about 6.6 per cent above January and 1.5 per cent over December.

Exports of industrial machinery during January were valued at $15,120,000, showing a slight decline from the $15,427,000 figures for December, 1927, but practically the same as during the corresponding month of 1927. Shipments of both oil-well machinery and steam engines (other than locomotives) fell off about 50 per cent. Balancing these outstanding decreases were gains in metal-working machinery, construction machinery, textile, sewing and shoe machinery.









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· TECHNICAL · ABSTRACTS ·

The Storage and Distribution of Industrial Lubrication

Most of us do not realize the enormous amount of oil and other lubricants that are wasted each year on account of lack of equipment for their storage and distribution. The average plant using quite large quantities of oil will usually find it advantageous to buy in carload lots as the savings possible often run as high as 20 per cent. In order to do this, it is necessary to have large tanks that will hold more than a carload of each kind of oil used. All incoming oil from tank cars or any other source should be metered in order to keep accurate records of receipts. Each disbursement of oil should also be measured or metered and a regular stockroom record kept of daily receipts and disbursements with a daily inventory of oil on hand.

It is best to have tanks in duplicate with all piping arranged in tandem, so that either one or the other tank may be used. When oils are required in modern quantities, they are usually stored in tanks located in the basement of the oil house, and still smaller tanks may be located in the oil house itself. Rectangular tanks take up less room and are, therefore, preferable to round ones where space is an important factor.

Where oil is consumed in large quantities it should be delivered wherever it is needed by pumping it through a suitable piping system from the storage point. Pumps of two general designs, rotary and reciprocating, are used for the purpose. Rotary pumps should maintain a uniform pressure on the discharge. They are usually direct-connected to a motor that may be started or stopped by push-button control at some distance. Reciprocating pumps may be either steam or motor driven. Hand pumps are used where only small quantities of oil are being handled. On hand pumps, a complete stroke of the piston usually displaces a measured quantity of oil and by attaching an indicating counter all oil pumped is easily measured. For power-driven rotary or reciprocating pumps a meter may be installed on the pipe line to record the oil pumped. These meters may be had in the automatic type that can be set to deliver any predetermined amount and then shut off a valve.—W. J. Ziegler, *Industrial Engineering*, February.

Why Some Drill Rod Steels Fail

Diamond drill rods are subjected in operation to torsion, repeated reversed bending, and radial and tangential stresses due to hydrostatic pressure of the cooling water. Failures are usually caused by the combined effect of torsion and bending. An unusual failure due to the cause named last was that of a rod of 1¼-in. outside diameter which failed at a depth of 2,600 ft. The failure consisted of a 12-in. longitudinal split accompanied by several cracks. Chemical analysis showed low carbon content of 0.24 per cent and high sulphur content. A microscopic examination showed banding of ferrite, uneven carbon distribution, and non-metallic inclusions. The cracks had followed the non-metallic inclusions.

There are two plausible explanations advanced: First, if in manufacture the interior was left rough and striated in a longitudinal direction, the notch effect may have been sufficient to cause failure even though the outside stresses were greater. Second, since the interior was badly corroded, the failure may have been due to a combined notch effect and corrosion fatigue such as reported by Doctor McAdam and R. R. Moore. An important feature of the case was that the stock was not purchased from specifications.—O. E. Harder, *Iron Age*, Feb. 23.

Equipment for Making Physical Tests

If the metallurgical laboratory were not costly to build, organize and maintain, only now and then would a manufacturer be found so short sighted as to do without his own technical department. The advantage of the laboratory as a tool in the hands of the management deserves careful consideration.

Usually the activities of a metallurgical laboratory are divided into two classes: the determination of the properties of products or raw materials by physical testing; and investigation of the causes of their disgregation from the desired characteristics and the correction of these conditions. It is possible to obtain data leading to the solution of a problem from the results of physical testing, while microscopic examination often predicts the physical properties of the material.

Physical properties having the greatest commercial interest in connection with the metal-working industries are: tensile strength, elastic limit, elongation, reduction of area, hardness, and toughness.—*Heat Treating and Forging*, December, 1927.

Jigs and Dies Have Many Uses in Shops of Chicago Surface Lines

Production of maintenance parts and special parts for various purposes about the Chicago Surface Lines is facilitated through the use of various jigs and dies. These insure uniformity and also accurate workmanship and hence save much time and trouble which would be necessary without them.

A form of die used for punching holes in small structural members that have been laid out with a center punch is arranged to locate the holes from the punch marks. When set up in the machine the end of the pointer corresponds exactly with the center line of the punch. When the work is removed so that the end of the pointer coincides with the center punch mark, the hole to be made is located and the punch itself will descend in the proper position. A wedge carried on an extension back of the punch enters the slot as the punch descends and forces the slide back to move the pointer out of the way while the hole is being made.

Another simple punch and die is used to construct countersunk slotted holes in 4-in. structural channel wear plates for truck pedestals. These particular wear plates are held in place with countersunk head screws with a lug on one side to prevent them from turning. The punch not only cuts and countersinks the hole but also forms the notch to take the projecting lug on the bolt.

A simple jig for holding brush holders while the brush slide is being broached has a movable block actuated by a hand screw, and which holds the brush holder against the block. The block is pinned at one end so that it can be raised out of the way, permitting insertion and removal of the brush holder.

A simple jig facilitates the boring of rebabbitted air-compressor connecting rods. The holding down strip is pinned at one end so that it can be swung out of the way allowing the connecting rod to be placed in its proper position. The wristpin end of the connecting rod fits snugly over the slug and is held in place by a tapered key. It is supported by a plate and the crankpin end is supported by pins. Side adjusting screws enable the operator to center the bore of the crankpin end with respect to the boring bar pilot hole in the base of the jig.—*Electric Railway Journal*, February 18.

Reorganizing to Increase Production

The problems that arise in reorganizing a factory for increased output and, at the same time, decreased productive and non-productive costs are generally of a domestic character due to the geographical disposition of plant and buildings. As the principles of progressive manufacture are gradually being resolved into a technique of their own these difficulties can be overcome on more or less accepted and well-tried lines, but the problems that arise become more difficult if output has to be maintained during the period of reorganization, and the process takes much more time to complete.

Naturally, the most satisfactory method that can be adopted to increase output without disturbing normal production is to build and equip an entirely new plant, leaving the old factory undisturbed, and then after the new one is complete and in production to alter the

old in accordance with more modern and progressive practice. As an alternative, the output can be stopped entirely and the existing plant remodeled to cope with potential increased business in the future.

Both these methods, however, are heroic in character. The first involves a capital expenditure that few firms can face, and necessitates either a building site adjacent to the existing factory, or else a duplication of staff resulting in a weakening of management, not only at and during the transition stages, but when both factories are running. This latter alternative involves a complete loss of turnover and profit during the remodeling process, dissolution of the operating staff that has grown up with the business, and a loss of morale that is difficult to regain.

The executive body responsible for the reorganizing process in either of the cases mentioned is indeed fortunate if it has a clear-cut job to perform and can carry out its program without interference. To alter and rearrange plant, however, with sales steadily increasing, and the fortunes of the company entirely dependent upon its weekly turnover, is much more difficult, and such a task throws a weight of responsibility on the personnel which might end in disaster unless a decisive and well-timed program is worked out and adhered to in its entirety.—By C. R. F. Englebach, *The Automobile Engineer,* February.

Avoid Trouble by Keeping Equipment Clean

There is an old saying that cleanliness is next to godliness and this saying is never more true than when applied to electrical equipment. Dirt of any kind is not only injurious to electrical equipment, but it is a direct cause of operating changes even if the equipment is not damaged. Dust is always present in every manufacturing plant and it requires constant vigilance to combat it. In a great many plants it is possible to collect a good portion of the dust by means of suction dust collectors. While the use of this type of equipment helps to a certain extent, there is a considerable amount of dust that the collector cannot touch.

From the viewpoint of cleanliness and lubrication it is safe to say that if every motor were equipped with anti-friction bearings, the number of failures due to bearing trouble would be greatly reduced. Ball bearings are so housed that it is impossible for dust or dirt to get into the lubricant and the lubricant seldom gets on to the windings. Not so, however, with the old type of sleeve bearings where unless extreme care is taken when oiling, any excess oil is drawn on to the winding by the air current caused by the fan action of the motor. Again if the bearings are not properly fitted, oil will siphon out and be drawn to the windings. One way of preventing this from happening is to cut a groove near the end of the bearing, so that the oil will be led back into the oil well through holes. In addition felt washers should be fitted over the shaft and fastened to the housing.

When lubricating a bearing the overflow should always be examined to see if the passage is open. Cases can be cited where no oil was visible in the overflow when the bearing was full. Never allow the overflow to become totally filled as there will be plenty of oil in the chamber to be picked up by the rings if they are working properly even when the oil is one-quarter inch below the top of the overflow. If a sleeve bearing motor is giving considerable trouble due to dirt getting into the lubricant, the best and cheapest remedy is to purchase new end bells and have them fitted with ball or roller bearings.

All motors and other electrical equipment should be cleaned periodically, the time between cleaning periods being determined by the amount of dirt collected. There are several types of vacuum cleaners on the market. One good feature about cleaning by vacuum is that the dust is not blown from one place to be deposited in another. Caution is required in the use of compressed air, since it always contains moisture. It should never be used in removing dust from commutators, and neither should high pressures be used on any winding.—H. E. Stafford, *Power,* February 28.

Power-Factor Control Ends D. C. Generator Troubles

Power-factor control has a more important feature than prevention of penalties on power bills. Increased production results from a power factor close to unity which permits equipment to be utilized at full rating thereby obtaining high efficiency with minimum horsepower ratings. An automatic control installed by the West Kentucky Coal Company has permitted an increase of 25 per cent in daily tonnage from one mine, according to John Harlan, division superintendent, thereby rendering extra equipment unnecessary. Previously, the 300-kw. synchronous motor-generator set, which furnishes d.c. power, would stop five to fifteen times a day due to overload. At present extra mining equipment is handled easily.

The automatic regulator was devised by Sherman Melton, electrical and mechanical engineer. Its field covers all synchronous motor-generator sets supplying direct current from an a.c. power source. It consists of a compound exciter, in this instance a 5½-kw. d.c. generator. The armature is permanently connected to the field of the synchronous motor through a rheostat. The shunt field is connected through a rheostat to the line, and the series field which is connected compound, is energized from a shunt on the negative side of the line. By proper setting of the exciter shunt-field rheostat and of the synchronous motor-field rheostat, the power-factor can be adjusted to hold automatically at any desired point in a practical range on either side of unity.

In operation, the power factor was held to about 98 per cent leading current with load varying from 0 to 100 per cent overload. The widest variation was from 90 lead to 98 lag. The response to load changes was instantaneous. Without the regulator the load factor averages approximately 70 per cent lead and was below 70 per cent much of the time. Savings were effected in the motor field current, while high excess line currents at light loads were eliminated.

Mr. Melton has applied for patents covering the regulator.—J. H. Edwards, *Coal Age,* February.

Automatic Rotary Hearth Furnace

An electrically heated furnace with a rotary hearth and automatic dumping mechanism has recently been placed in operation in the heat-treating department of the Nash Motors Company. It is circular in shape, 12 ft. 6 in. in diameter and 6 ft. high. It has an annular heating chamber, sealed at the bottom by an annular, rotating table.

To prevent air leakage into the chamber through the clearance spaces between the rotary hearth and the furnace walls, sand seals are provided at both inner and outer peripheries of the table. The sand is carried by the rotating member and is thus evenly distributed.

The rotary hearth is supported by a ball thrust bearing and driven by an electric motor through reduction gearing. It can be arranged to advance continuously or intermittently. The mechanism can be adjusted to provide a heating period of any duration up to two hours.

Segment-shaped cast alloy trays are so mounted on the rotary hearth as to move in a vertical plane about an axis that is tangent to the outer circumference of the furnace. A discharge mechanism, driven by a separate motor, lifts each tray in turn as it arrives at the discharging point and dumps its content into an alloy chute that conducts it to one or other of two tanks located adjacent to the furnace, one containing oil and the other water.

Movements of the hearth and of the discharge mechanism are interconnected through interlock switches so that each is controlled in turn by the preceding movement. Suitable control switches allow the discharging mechanism to remain idle while the furnace is warming up.

The electric heating equipment consists of 80-20 nickel-chrome rolled ribbon resistors supported on and spaced away from the furnace walls by special refractory hanger bricks which present a knife-edge contact to the resistors. The resistors are divided into two control zones with independent instrument and control panels.

The furnace walls consist of a high-grade refractory brick, and the arch is of tile. Temperatures up to 1,740 deg. F., are carried. The structure is encased in steel plates, suitably reinforced with structural shapes. The doors and frames are of cast iron.—*Fuels and Furnaces,* February.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Shipmindedness

AMERICAN business men pride themselves on their ability to think clearly. On most subjects there is surely some justification for this feeling but when it comes to the merchant marine the clarity of thought seems to be lacking. It may be remarked that the rest of the country is no different from the business portion where ships are concerned. What is needed is a certain amount of "shipmindedness."

The war left the United States with something that had not existed for several decades, a merchant marine. At present some three hundred ships are in commission and five hundred are in reserve. The United States Shipping Board is the trustee for the merchant marine and is charged with the responsibility of getting it into private hands as soon as may be economically possible. Why has it been so slow in doing so?

The answer to such a question is easy to find. Because of the higher first cost of American-built ships, the higher cost of operating them and the traditional policy of the country against any form of ship subsidy there is only a remote chance that a private firm can operate such ships in competition for world trade.

On the other hand, there is the strongest opposition to the continuance of the Government in the shipping business. As a consequence, in the nine years since the war, no new ships have been built for foreign trade and the whole machine is therefore well on the way to obsolescence. If nothing is done about it, it will not be long before the American merchant marine disappears once more.

Such an outcome may not be of much concern to many people, but it is a serious matter to the American industrialist who must find a foreign market for a part of his production. The modern ship captain is an able advance agent for the commerce of his country, for he knows the markets on his route. Take him out of the picture and entrust goods to foreign ships and skippers, and it will be surprising how quickly the repeat orders stop coming to American manufacturers and go to the countrymen of the foreign skipper in whose ship the goods must be carried.

For this reason, if for no other, American industry must cultivate an attitude of "shipmindedness" and demand from Congress constructive action on the merchant marine problem.

Efficiency and Unemployment

INDUSTRY seems to be facing a new problem —that of increased output and increased unemployment at the same time. The greater use of more efficient machinery is constantly widening the gap between the volume of production and the labor required in the process. The result is an increased percentage of unemployment.

Bearing out this tendency we have the statistics of a number of industries covering a five-year period which all show a larger output with fewer employees. Oil leads the list, showing eighty-four per cent greater output with five per cent less men than before. Railroads do thirty per cent more work with one per cent less employees, and so on down the list. In every case the number of employees per unit of output has decreased to a marked degree.

Such a result is to be expected and accounts for the lowered price of some commodities. On the other hand, it introduces the serious problem of unemployment, not only of individuals, but of plants. In fact, many concerns building the machinery that has made possible the increased output with fewer men, are themselves at least partially unemployed, and so add to the unemployment of the country.

This lessening of the number of employees necessary to turn out a given product makes unemployment a serious problem for industry, as well as for the individual. For unemployment means a decreased market and a check on the large production schedules that have made possible the low costs now in effect.

Two of the suggested solutions may be worth consideration although neither seems easy of accomplishment. One is to work for the decrease of sales costs rather than production costs, so as to widen markets enough to employ as many as formerly. The other is to decrease the output by lessening the number of hours worked per week. In order to provide the same purchasing power the weekly wage must remain as before, which would add to production costs unless offset by even greater efficiency. It is quite possible that both suggestions may be considered as part of the same solution, if it really is a solution, to this very serious problem.

Schuttoff Universal Relieving Lathe

MANY special features are incorporated in the Schuttoff universal relieving lathe marketed in this country by the George Scherr Company, 142 Liberty St., New York, N. Y. All change gears for the lead, helix, and number of gashes are located at the headstock end of the machine; by this design extra shafts are eliminated and greater accuracy is produced. For relieving multiple-thread hobs, a special dividing attachment is provided and it is not necessary that the number of threads to be produced should be divisible into the number of teeth of the driving change gear. Another feature is an automatic trip for disengaging the relieving motion on the return travel of the carriage. A stop is provided for obtaining the proper and uniform depth of tooth and relieving hobs. In Fig. 1 the Model UHD-3L machine with single-pulley drive is shown, Fig. 2 shows a form-grinding attachment applied to the unit, while Fig. 3 shows a special forming slide.

These relieving lathes can be used for the manufacture of relieved milling cutters and similar tools such as spiral and end mills, fly cutters, angular cutters, thread-milling cutters, hobs, taps, reamers and dies. Straight left- or right-hand spiral gashes can be machined. In addition, the machine may be used as an ordinary tool room lathe. All Whitworth threads from 1/20 to 15-in. pitch, metric and module threads may be cut. The number of teeth to be relieved may vary between 2 and 40, and the lead of the spiral gashes from 3 to 400 in. The relieving motion may be either left- or right-hand.

The bed is a heavy box casting reaching the floor and has separate V's for the tailstock and the saddle. The top portion of the interior forms a collecting pan for chips, which can be easily removed through an opening. Underneath a useful tool cabinet is formed. The headstock is rigid and is held to the bed by screws. By means of a single lever a given lead can be multiplied 16 times without alteration of the change gears. Another lever controls the reversing and stopping of the spindle. A 4-step cone pulley in conjunction with back gears gives eight spindle speeds ranging from 2½ to 220 r.p.m. All change gears for producing spirals and for the differential movement, as well as for obtaining the required number of gashes, are located at the front and back of the headstock. For producing hobs with multiple start, a special attachment is provided to allow quick and accurate indexing without altering any of the change gears.

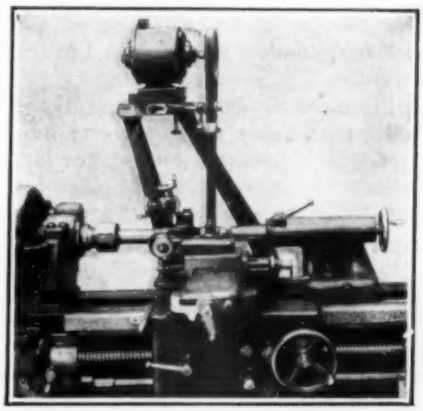


Fig. 2—Form-grinding attachment

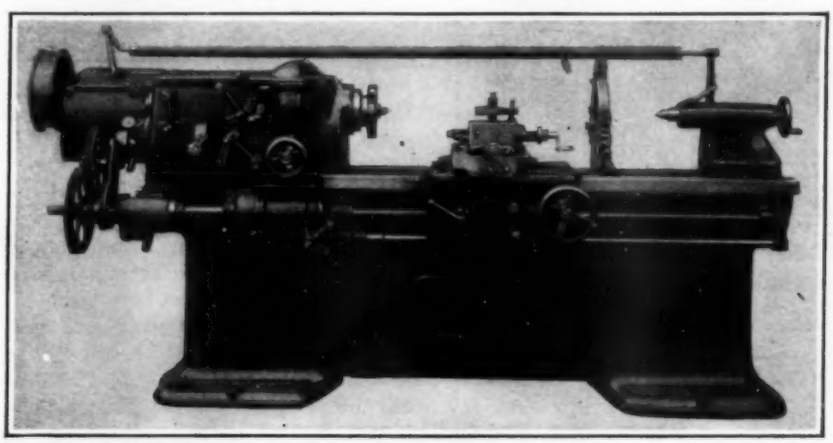


Fig. 1—Schuttoff Model UHD-3L Universal Relieving Lathe with Single-Pulley Drive

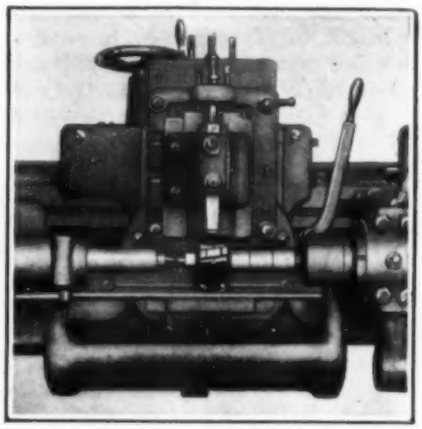


Fig. 3—Special forming slide for the relieving lathe

The spindle is made of high-grade special steel, hardened and accurately ground. The front bearing is tapered while the rear bearing is cylindrical. Both bearings are of liberal dimensions and have adjustable bronze bushings. The axial pressure is received on hardened and ground steel washers adjacent to the rear bearing.

The saddle is of heavy design to withstand the shock load. The longitudinal traverse is by change gears and lead screw with a split phosphor-bronze nut. The quick adjustment of the saddle is by handwheel, pinion, and rack. The reciprocating motion of the top slide is obtained by interchangeable cams, corresponding to the cutting angle of the tools to be produced. The top slide swivels in a complete circle on a graduated base. All adjusting spindles have micrometer collars.

The tailstock has a separate V-track on the bed, and is of the set-over type. The spindle is adjusted by handwheel, and its front is bored with a Morse taper for receiving the outer end of the work mandrel. The copying top slide is used for the manufacture of irregular profile cutters with spiral gashes. It is interchangeable with the ordinary top slide and can be supplied either with the machine or at a later date. In Fig. 3 this special forming slide is shown.

The lathes are made in four models,

UHD-3, UHD-3L, UHD-4, and UHD-4L. The first two models have a height to center of 8⅞ in., and a distance between centers of 23⅝ and 40 in. respectively, while the last two models have a height to center of 10¾ in. and distance between centers of 29½ and 60 in., respectively. The maximum swing over the saddles is 9¾ in. for the No. 3 machines and 11¾ in. for the No. 4 machines. The floor space required varies from 30 to 41 sq.ft., and the net weight varies from 4,200 to 6,060 lb., while the gross weight boxed varies from 4,630 to 6,620 pounds.

"Pfauter" No. 9 High-Production Hobber

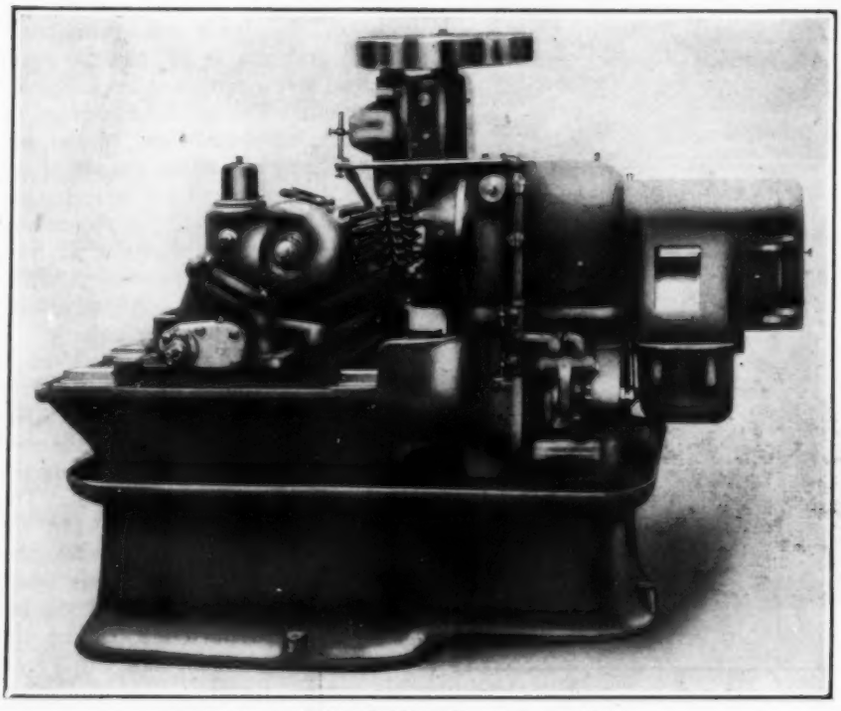
THE "Pfauter" No. 9 high-production hobber is being marketed by O. Zernickow Company, 15 Park Row, New York, N. Y. It is intended for heavy-duty production work at high speed. It has a single pulley drive, and can be arranged for direct-connected electric motor drive. The hob speeds are obtained through change gears, which have large tapered bores and are therefore quickly put on or taken off. The cutter head swivels in either direction to 100 deg. The setting is accomplished by means of a worm drive located inside of the head.

The hob is driven by means of a spur gear drive with heavy flywheel on the driving pinion thus imparting a steady motion to the hob. The hob spindle is hardened, ground and adjustable lengthwise and sideways. The index drive consists of a worm gear of great accuracy, and a hardened steel worm ground all over. The worm is adjustable in both directions and runs in an oil bath.

The No. 9 hobber is suitable for spline shafts and spur gears of small diameter, heavy pitch and wide face, and worms for automobile rear axles. The work is held between centers or in split collets. The radial hob pressure is taken up by means of a steady rest. Any desired feed is obtained through change gears. The feed is stopped automatically or by hand.

The cutter head remains stationary, while the work travels. All outside change gears are inclosed with cast-iron guards, but are readily accessible. A coolant tank is placed in bed of the machine.

Standard equipment consists of the following: index gears for one job; feed gears; hob centering gage; hob arbor with rings, and a split collet for one job. An overhead countershaft is provided when the machine is belt driven. All wrenches, spanners and other tools as well as a complete pump are provided.



"Pfauter" No. 9 High-Production Hobber

SPECIFICATIONS

Swing, in.	10⅜
Distance between centers, in.	21⅛
Maximum gear diameter, in.	10⅜
Maximum pitch, D.P.	2¼
Minimum center distance hob and work arbor, in.	1¼
Number of teeth	4–100
Bore of spindle, in.	3½
Diameter of hob arbor, in.	1¼ or 1½
Maximum diameter of hob, in.	5¾
Maximum length of hob, in.	5½
Shifting of hob, in.	1⅜
Speed of hob, r.p.m.	44 to 127
Motor hp.	7
Motor speed, r.p.m.	1,000
Floor space, in.	69x86
Net weight, lb.	5,500

Thor Rotary Air-Driven Grinders and Sanders

A line of rotary air-driven grinders and sanders has been placed on the market by the Independent Pneumatic Tool Company, 600 west Jackson Blvd., Chicago, Ill. The outstanding features are the balanced motor,

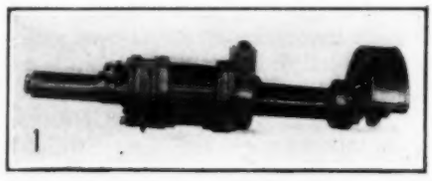


Fig. 1—Thor No. 272 Rotary Air-Driven Grinder. Fig 2—The No. 271R Rotary Sander

the governor, the lubricator and the muffler.

The motor, carrying four balanced Bakelite blades which are unaffected by oil, water or heat, is very light. It is mounted on a rigid shaft, suspended in oversize ball bearings. The spindle is also suspended and held in alignment by large ball bearings. The governor, which is adjustable, is fully-inclosed and cannot get out of order, it is claimed. It keeps the free

speed and air consumption low, until the wheel is applied to the work and then it automatically throttles to the speed and air required for the job.

The automatic oiler carries sufficient light oil to lubricate all moving parts for eight hours, thus preventing wear. The baffle plate muffler, incorporated in the box-like lug on the spindle support, makes a quiet, comfortable motor to handle. It is claimed that these machines will show great savings on any grinding or sanding work on which they are used.

The Thor No. 271 grinder weighs 15½ lb. and is 21¼ in. long. It has a straight handle throttle. The speed is 4,000 r.p.m. The air consumption at no load is 20 cu.ft. at 90 lb. per sq.in. It carries a 6-in. emery wheel, 1½ in. across the face. The No. 272 grinder, shown in Fig. 1, weighs 17¼ lb. and is 19¾ in. long. It has a grip handle throttle. The speed is 3,200 r.p.m. It has the same air consumption as No. 271 grinder and carries an 8-in. emery wheel, 1½-in. face.

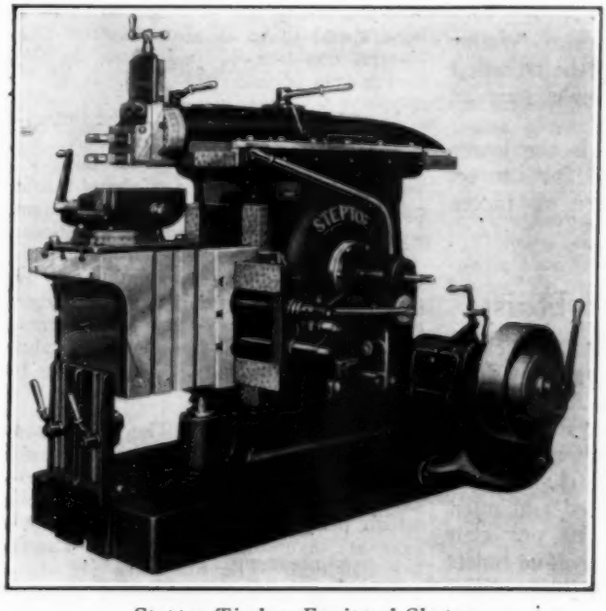
The Thor 271R sander, Fig. 2, has a right-angle housing. The length overall is 14 in. The speed is 4,000 r.p.m. It has the same air consumption as No. 271. It carries any size flexible disk up to and including 9 in. in diameter.

Steptoe Timken-Equipped Shapers

TIMKEN tapered roller bearings have been applied by the Western Machine Tool Works, Holland, Mich., to the drive of their line of Steptoe shapers. These machines are claimed to be able to take exceptionally heavy cuts.

The length of stroke can be adjusted by means of a self-locking device while the machine is at rest or in motion. The ram can be quickly adjusted to suit the position of the work, and a short stroke can be taken at any point. The ram is of semi-circular section, strongly ribbed. The long, heavy square guides prevent any tendency for the cutting tool to lift and push the ram sideways. The speed box is of the selective type, and is equipped throughout with Timken tapered roller bearings. It is a complete unit and provides four changes of speed. These combined with the back-gear drive produce a total of eight cutting-speeds for the ram. All gears are made of chrome-nickel alloy steel, heat-treated and hardened. They are of coarse pitch and wide face and run in an oil bath.

Simplified lubrication requirements are another feature of the Steptoe shapers. The bearings are all pressure grease-lubricated, and, since they are inclosed in grease-proof, and dust-tight closures, lubricant need only be renewed about every three months. The closures are so designed as to form reservoirs that will contain enough lubricant to last over this period without danger of allowing the bearings to run dry. This line of shapers is built in four sizes of 14-, 16-, 20-, and 24-in. stroke that are available in single- and back-gear styles for the two intermediate sizes. The 14- and 24-in. sizes are built in single- and back-gear styles respectively. These machines can be arranged for direct connection to either constant-speed or adjustable-speed motors through a metal-to-metal clutch or single-pulley drive with speed-box or cone-pulley drive.



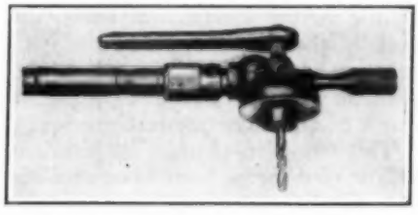
Steptoe Timken-Equipped Shaper

The strokes per minute for motor drive or single-pulley drive with gear box vary from 20 to 61 for the smallest size and from 5 to 64 for largest size. For cone-pulley drive, the strokes per minute vary from 15 to 52 for the smallest size and from 5 to 70 for the largest size. The weights vary from 1,975 to 4,100 lb. The floor space required varies from 46x65 to 59x104 inches.

Stow Angle Drilling Head

This tool which derives its power through a flexible shaft has been presented by the Stow Manufacturing Company, Binghamton, N. Y. It is particularly adapted to drilling in out-of-the-way places. The flexible shaft may be driven by an ordinary electric drill or available motor.

The angle head is of modern construction, built to withstand hard service. It is furnished, commonly, in ½-in. capacity but may be had in other sizes with 1¼-in. screw-feed with ratchet hand. The socket takes standard Morse taper drills and where space permits a chuck may be applied.



Stow Angle Drilling Head

General Electric "Flex" All-Rubber Cord Sets

Cord sets made up in 10 and 20 ft. lengths of No. 16 and No. 18 type SJ GE-Flex Junior all-rubber cord are announced by the Merchandise Department of the General Electric Company, Bridgeport, Conn. One end of the cord set has an all-rubber cap, while the other end is stripped ready for wiring. This set may also be obtained with a pony attachment compound plug body and an all-rubber cap. The cord and cap consist of one mold, the prongs being molded into the cap so that no wiring of the

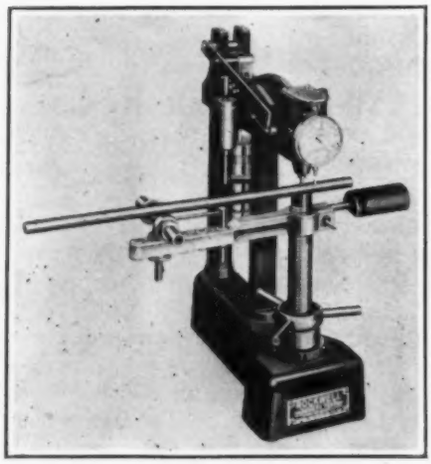
cap is necessary. This method of construction also eliminates the breaking of wire in cord holes, or the breaking of the compound.

This set is particularly recommended for hard service, and is suitable for use in general industrial works.

"Vari-Rest" Attachment for Rockwell Hardness Tester

In order to provide additional support for pieces to be tested on the Rockwell hardness tester, the Wilson-Maeulen Company, Inc., 369 Concord Ave., New York, N. Y., has introduced an adjustable jack support, known as the "Vari-Rest" attachment. It is designed for supporting a variety of shapes and sizes. The illustration indicates one of the many possible ways of using it. The basic idea is to support the piece so that it does not slip, roll or in any way shift during the application and withdrawal of the minor and major loads, especially the major load. Failure to support an overhanging, unbalanced piece may break the diamond Brale or result in an inaccurate test.

This support permits adjustment till the piece being tested rests solidly and firmly upon the anvil of the tester and then as the handwheel is turned to carry the piece up against the penetrator for contact and for application of the minor load, the anvil, the piece to be tested and the support are all elevated together and in undisturbed relation to each other. The arm is made of aluminum and there is an adjustable counterbalance. Only approximate counterbalancing is necessary to prevent strain on the standard.



"Vari-Rest" Attachment for Rockwell Hardness Tester

In using the Vari-Rest, the wing screw which clamps the frame to the elevating screw of the tester, is loosened and the frame is raised or lowered to bring it to approximately its proper position while the work is on the support. Then the wing screw is tightened and the fine adjustment is operated. If round work is to be supported, it will rest directly on the horizontal tubular bar, which is adjusted by turning the upper knurled ring until the work lies squarely along the V anvil. The two collars on the tubular bar prevent the work from rolling but they should not be brought so close together that they bind or touch the work for unless the piece tested is straight they might cause it to lie in an oblique line across the V anvil, and the piece would then shift as the load is applied. For like reason no V groove is turned in the supporting bar. The V-notch through the anvil must alone determine the seating of the rod in the anvil.

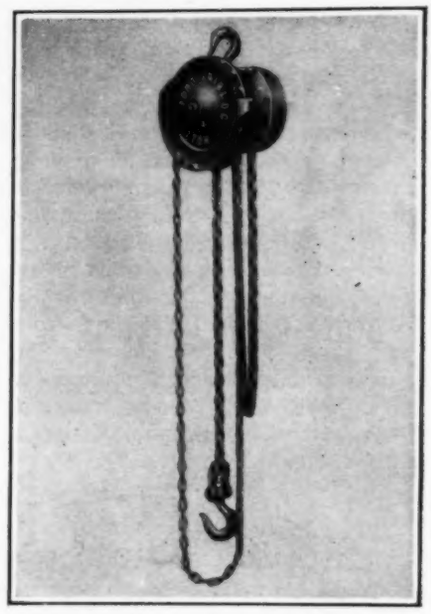
In testing flat pieces which may be slightly warped, the work is supported by resting it on the top of the two collars, one of which is eccentric, instead of directly on the horizontal tubular bar and then by turning the eccentric collar a three-point support is made by these two collars and the spot anvil.

The two collars slide and turn on the tubular bar with an easy but firm frictional grip. The eccentric collar is used in front and can be adjusted to provide higher or lower support than the circular collar.

The lock nut, which is the lower knurled nut, is supplied for use on production testing where all pieces are of like shape.

Ford "Tribloc" Hoist

High-carbon electrically-welded chain is being made by the Ford Chain Block Company, 2d and Diamond Sts., Philadelphia, Pa. Every link is proof tested with special instruments and when the chain is assembled, it is again tested and must show an overload of 50 per cent above its rated capacity. The hoists using this chain are built in capacities from ¼ to 20 tons. It is claimed by the company that the Ford "Tribloc" hoist represents the utmost in durability and efficiency.



Ford "Tribloc" Hoist

Trade Catalogs

CHAIN DRIVES. The Diamond Chain & Manufacturing Co., Indianapolis, Ind., has released booklet No. 104 entitled "Simplifying and Improving Machine Design," which should be of interest to machinery designers in many industries. It is profusely illustrated with applications of both single- and multiple-strand chain as internal drives. The increasing use of roller chain as a high speed drive is also shown. The booklet contains 40 pages and is the fourth of a series.

MILLING ATTACHMENTS. The Porter-Cable Machine Co., Syracuse, N. Y., has issued a small catalog describing its vertical attachments for hand- and power-feed, single- and double-overarm high- and low-speed milling machines. These devices are designed to permit the cutter to operate at any angle in any plane. The line includes angular, universal and heavy-duty attachments, and is supplemented by small tools also made by the company. The catalog is well illustrated.

SPEED REDUCERS. The Morrison Machine Co., Paterson, N. J., has issued a catalog describing its line of speed-reducing transmissions. Two models which provide definite limits of reduction are available. Dimension sheets are included. The machines are suitable for horizontal, vertical or angular drives. The catalog is well illustrated.

NEWS OF THE WEEK

A.S.M.E. Material Handling Division to Hold First National Meeting

THE Materials Handling Division of the American Society of Mechanical Engineers will hold its first National Meeting in Philadelphia April 23 and 24 at the Hotel Benjamin Franklin.

The division is one of sixteen professional divisions of the American Society of Mechanical Engineers and it has been very active in encouraging and presenting better handling methods. It is the only organization covering the entire field and is naturally without bias in its activities. More than 2,000 engineers are enrolled in the division.

American industry, it is asserted, is beginning to awaken to the seriousness of its annual loss due to inefficient material handling which has been estimated by competent authorities to be in excess of $3,000,000,000 yearly.

This is the first National meeting ever arranged in the interest of this vitally important topic.

Program: Monday, April 23.

10:30 a.m. Foundry Session—The presentation of two very remarkable systems of handling installed in foundries—steel and cast iron.

1:30 p.m. Plant Inspection Tours—Choice between several tours. Arrangements have been made to inspect some very efficient handling systems in certain local industries.

7:00 p.m. Dinner (Informal) Meeting—Speakers of national prominence will present interesting and valuable views on the various aspects of materials handling.

Tuesday, April 24.

9:30 a.m. External Handling and Transport Session—Papers on the handling of material at railroad terminal, door-to-door distribution and marine terminal handling.

2:00 p.m. Interior and Bulk Handling Session—Papers on interior handling, production control by handling and exterior bulk handling at plants and terminals.

8:00 p.m. Mechanization of Coal Mines Session—Jointly with National Coal Association and American Institute of Mining Engineers, Philadelphia section.

Marketing Parley Planned

The American Management Association will hold its marketing executives' conference in Chicago from March 28 to 30. The program has been divided into two parts, the "Controlling of Marketing Costs," and the "Training of Salesmen." C. S. Ching, president of the association, will speak on the "Relation of Marketing to National Prosperity," at the luncheon on March 29. R. L. Putnam, vice-president of the A. W. Shaw Co., will speak on, "Will the Airplane Effect Marketing and How?"

Metal Trades Planning West Coast Exhibit

Twelve national societies and associations having branches in Western States are arranging to take part in the program for the Western Metal Congress to be held in the Shrine Auditorium, Los Angeles on January 14, 15, 16, 17 and 18, 1929. The exposition is being sponsored as a double event by the Western Metal Congress and the Western States Metal & Machine Tool Exposition.

It is announced that already more than 100 Eastern firms have advised the arrangements committee of their intentions of attending and many have asked for reservations of display space. The exhibit is being planned as a comple cycle of the metal industry, including raw materials, machine tools, heat-treating apparatus and supplies, inspection equipment, foundry supplies, materials handling, welding and cutting, oil field tools, small tools, machinists' supplies and finished metal products.

Finds New York's Lead in Industry Menaced by Legal Restrictions

That New York State has reached the point where its industrial development is beginning to lag, and is being surpassed by states such as Pennsylvania, Ohio, Michigan, Illinois and New Jersey, where statutory regulations are not so restrictive, is alleged in a report just submitted to the state Legislature by the Industrial Survey Commission.

"New York State," the report sets forth, "made relatively less progress industrially between 1914 and 1923 than the United States as a whole, or than its chief competitive states as measured by the increase in workers employed in its manufacturing industries or in the value of their products, in proportion to the increase that has taken place in the local market through population growth.

"It is probable that it will become increasingly difficult for New York to maintain its lead in the future against such states as Michigan, Pennsylvania, Ohio, Illinois and New Jersey and other states in the South and West where industry is developing rapidly along modern lines and with less advanced statutory regulations in the welfare of the working population."

These conclusions, the report points out, are based on a study made for the Industrial Survey Commission by the National Industrial Conference Board. Among the outstanding recommendations made by the commission were: that a longer trial of the 48-Hour Week Law should be given before any attempt is made to amend it; that the Compensation Law be amended and that no lump sum award of more than $500 be permitted, except by a member of the industrial board; and that referees in the compensation bureau be appointed by the Appellate Division of the Supreme Court.

U. S. Tool Makers Will Exhibit in Moscow

The permanent machine tool exhibit which will open next May in Moscow, and which project is being sponsored by the Soviets for the development of new production methods to be introduced into the old Russian metal industry, will have exhibits by fourteen American manufacturers, it has been announced by the Amtorg Trading Corporation.

The exhibition is to be housed in a special $1,000,000 building, being constructed by the Orgametal Co., a Soviet engineering concern which is designing four machine building plants to be erected within the Soviet Union at a total cost of $34,000,000. German, Swedish and French firms also will take part in the exhibit.

Commerce Department to Open Additional Branch Offices

Among the recent developments of the Bureau of Foreign and Domestic Commerce of the Department of Commerce, made possible by added appropriations for the fiscal year, will be the establishment of six new district offices. These branches are to be located in Denver, Indianapolis, Birmingham, Pittsburgh, Milwaukee and one in North Carolina. The Commerce Department already maintains 23 district offices and 34 co-operative offices in the United States.

Records of the department show that during the past fiscal year these offices performed more than 2,000,000 commercial services, an increase of approximately 600 per cent during the past five years. These branch offices are equipped

with foreign trade information regarding conditions abroad, such as sales openings, names of prospective buyers packing suggestions, foreign tariffs and the like. Facilities for the promotion of domestic trade also are being developed.

Dr. Davis of Harvard Selected to Head Stevens Tech

Dr. Harvey Nathaniel Davis, now occupying the chair of mechanical engineering at Harvard University, Cambridge, Mass., has been selected as president of Stevens Institute of Technology at Hoboken, N. J., to succeed the late Dr. Alexander C. Humphreys who resigned last June after 25 years of service. Dr. Davis will assume his new duties on September 1 next. Dr. Humphreys died on August 14. Dr. Frank L. Sevenoak, a member of the Institute faculty, has since served as acting president.

Dr. Davis has an outstanding reputation as economist and educator, as well as engineer. He has been professor of mechanical engineering at Harvard since 1919 and previously served as instructor and assistant professor in physics there. His professional activities, outside of the educational field, include engineer in the turbine department of the General Electric Co. aeronautical mechanical engineer in the United States Air Service, consulting engineer in the U. S. Bureau of Mines, the Franklin Railway Supply Co., and the Air Reduction Company.

Dr. Davis was born in Providence, R. I., 1881. He is a son of the late Nathaniel French Davis, eminent mathematician, and of Lydia Martin (Bellows) Davis. He was graduated with distinction at Brown University, where he received the degrees of A.B. and A. M. He then entered Harvard University, his work there leading to the degrees of A.M. and Ph.D. Subsequently he joined the Harvard faculty.

Dr. Davis is a Fellow of the American Academy of Arts and Sciences, a member of the Washington Academy of Sciences, of the American Society of Mechanical Engineers, the American Physical Society, and the American Mathematical Society. He is the author of various papers on thermodynamical subjects and is a leading authority on high pressure steam.

Fewer Cars Produced in Canada in 1927

A report just issued by the Dominion Bureau of Statistics shows that production of automobiles in Canada in 1927, totaling 179,383 cars valued at $117,569,132, marked a decline of 13 per cent in number and 6 per cent in the total sales value f.o.b. plant, when compared with the corresponding figures for 1926. While fewer cars were produced in 1927 than in 1926, the record year, the number produced was greater than in 1925 by 10 per cent and also 13 per cent higher than in 1924.

During the year under review imports into Canada of motor cars increased 28 per cent in number to 36,360 from 28,535, while exports declined 23 per cent to 57,793 from 74,553. The apparent consumption of cars in Canada, as determined by deducting the exports from the sum of the production and imports, showed little change from the previous year and amounted to 158,220 cars as compared with 159,098 cars in 1926.

That conditions in Canada during 1927 were basically favorable to the automobile industry is borne out by the fact that, although the selling prices of a great variety of models were considerably reduced, the average selling value of all cars made in 1927 was $49 greater than in 1926.

Long Shut Down Ends

After a shut down since last May the Kensington, Pa., shipyard plant of William Cramp & Sons, Ship and Engine Building Company, has resumed operations. It now is being operated under the name of Kensington Shipyard & Drydock Company. The directors of the new corporation are Francis J. McDonald, Sydney E. Hutchinson, J. S. W. Holton, president of the Maritime Exchange; William Finley Brown and Thomas F. Sullivan. New officers elected were: Francis J. McDonald, president; John E. Worthington, treasurer, and Francis J. McDonald, Jr., secretary; John Watt, superintendent.

U. S. Engineers Outline Tokio Congress Plans

Additional details of the itinerary planned by the American Committee to the Congress of World Engineers to be held in Tokio, Japan, in October 1929, have just been announced by that organization. Seventy-eight of the nation's most prominent engineers and scientists have been appointed by Secretary Herbert Hoover. The entire project is under the sponsorship of the Japanese government and the session will cover a period of two weeks.

The congress proposes to discuss a wide variety of engineering subjects (tenatively arranged) in anticipation of initiating and promoting international co-operation in the study of engineering in all its branches and to cultivate a feeling of brotherhood among engineers of the world. Among subjects already outlined are:

General problems concerning engineering, such as education, administration, management, statistics, standardization, international co-operation of engineers; engineering science; strength of materials, thermodynamics and other scientific researches; architectural and structural engineering, mechanical and electrical engineering, chemical engineering, textile industry, shipbuilding and marine engineering, aeronautical and automotive engineering, road vehicles, mining and metallurgy, engineering materials, fuel and combustion engineering, water works, drainage, heating and ventilation, illumination, refrigeration, scientific management and other phases of engineering under miscellaneous listings.

University Afloat Offered Engineers in July

An engineering tour to Europe for factory and public utility executives, instructors and students in engineering colleges, and others who wish to study these subjects under expert direction, is announced in a current bulletin of the School of Foreign Travel, Inc., New York City. The course and tour, for which a combined fee of $570 is charged, will begin July 14, the time of embarkation on the S.S. Tuscania, New York, and terminate Aug. 24 at the starting point. Power plant economics and industrial organization and management are included in the course. N. C. Miller, director of the University Extention Division of Rutgers University, New Brunswick, N. J., will be in charge of the faculty.

Cupola Operation Key Note at Convention

The thirty-second annual convention of the American Foundrymen's Association will meet at the Hotel Bellevue-Stratford and the Commercial Museum, Philadelphia, for its technical sessions and exhibits, May 14 to 18. The technical sessions are scheduled for the mornings in the hotel and the foundry exhibits at the afternoon meetings in the museum.

An innovation this year to interest the practical men in cast-iron foundries, operating and working with cupolas, will be the four-period cupola operation discussion course. These discussion groups will be held on the first four days of the meeting.

A special room in the exhibit hall is to be set aside for technical displays which will include such exhibits as the moulding, sand-testing and control exhibits of the joint committee on foundry sand research.

Air Associates Inc. Stirs Interest in Aviation

Products and services of practically every manufacturing and operating branch of aviation are being displayed by the newly formed Air Associates, Inc., 44th St. and Fifth Ave., New York, N. Y. Authoritive facts about flying are kept tabulated for use in answering public demand for information. Already 24 manufacturers and operators have placed their products on exhibition or illustrated their services.

Officers of Air Associates, Inc., are Haven B. Page, president and organ-

izer; James B. Taylor, Jr., vice-president; Beauregard Sweeney, treasurer.

Engineering counsel for the concern is represented by many distinguished figures in aviation. Members of the staff include Professor Alexander Klemin, head of the Guggenheim School of Aeronautics at New York University; C. Fayette Taylor, associate professor of aeronautics at the Massachusetts Institute of Technology; Kenneth M. Lane, chief plane engineer of the Wright Aeronautical Corporation and Archibald Black, air transport consultant, who now is chief engineer of the Langley Corporation for airports and operations.

Cleveland Men Win Design Awards

Two equipment designers of the National Lamp Works, Cleveland, Ohio, a subsidiary of the General Electric Company, are the recipients of Charles A. Coffin awards for 1927, for their inventions in lamp-making equipment which resulted in a saving of $190,000 in labor cost and a machine investment saving in excess of $400,000, in addition to great economy of floor space occupied by the old-type machine.

The winners of the awards are John J. Malloy, designer and builder of a basing and soldering machine for miniature incandescent lamps, and Ludwig Saudenmeir, designer and builder of a combination stem and inserting machine for lamps, radically different from existing equipment.

The General Electric Company awarded $51,557 to 4,919 of its employees during 1927 for their suggestions tending to improve working conditions or increase the efficiency of the company's operations. During the year 15,059 suggestions were offered, an increase of more than 500 for the previous year, and more than 52 per cent was accepted.

Welding Society to Hold Meeting in April

Opening on Wednesday, April 25, with a series of committee meetings the American Welding Society, 33 West 39th St., New York City, will devote a three-day session to its annual convention, it is announced. The pressure vessels committee, presided over by E. H. Ewerts, chairman, will be the first business of the opening day, and will be devoted to the outlining of specifications to be followed in making tanks and specimens already decided upon.

A review of structural steel welding methods and progress made in this work during the past year will be taken up by the structural steel welding committee on the afternoon of the 25th. Technical and business sessions and the annual dinner at the Engineers' Club will occupy the second day, when standardization procedure in welding, qualification of welders, inspection and supervision and pipe welding will be discussed.

The third day will be given over to the Board of Directors' meeting, the annual meeting of the American Bureau of Welding and a review of the progress made by various research committees of the bureau during the past year.

Foreign Trade Convention Appeals to Nation

Announcement of the Fifteenth National Foreign Trade Convention to be held at Houston, Tex., April 25 to 27, is addressed to "all those who are interested in the development of foreign trade as a factor of national prosperity." Representatives of commerce, agriculture, education, industry, finance and transportation are urged to attend.

There will be no group sessions this year. The three periods heretofore devoted to such sessions will be given to general sessions, in which there will be expert presentation of export merchandising; these sessions running consecutively.

Addresses will include "The Foreign Trade Outlook," "The Prospect in Europe," "Foreign Trade Developments in the Gulf States," "Packing and Shipping," "Marine Insurance," "Foreign Trade Progress," by James A. Farrell, president of the U. S. Steel Corporation and chairman of the National Foreign Trade Council. The three Export Merchandising Sessions will cover the world trade of the United States.

Joliet Merger Aims to Aid Industries

The Joliet Development Foundation has been organized as a subsidiary of the Joliet Chamber of Commerce with a $400,000 fund as objective to construct buildings for new industries and extend financial aid to those considered worthy of civic support.

Money expended from the fund for industrial and manufacturing plants will be repaid through a series of monthly installments by the benefiting corporation.

Fred J. Walsh, president of the chamber of commerce is head of the committee and has reported that already $100,000 has been subscribed. Each subscriber pledges $1, $2 or $3 for each new job created under the fund, a plant employing 1,000 obligating subscribers of the $1 class to $1,000.

Railroad Notes

Class 1 railroads in January installed 154 locomotives into service an increase of 9 locomotives at compared with January, 1927. Locomotives on order on Feb. 1 totaled 173 compared with 318 on the same date last year and 493 on the same date two years ago. The railroads, on Feb. 1, had 19,048 freight cars on order as compared with 29,042 on Feb. 1, 1927 and 50,636 at the same time in 1926. Locomotives in need of repair on the Class 1 roads of the United States on Feb. 15 totaled 9,349 or 15.5 per cent of the number on line. This shows an increase of 616 locomotives compared with the number in need of such repairs on Feb. 1, at which time there were 8,733 or 14.5 per cent.

Expenditures for locomotives in 1927 amounted to $76,975,000 compared with $108,263,000 in the preceding year, while for freight train cars $136,490,000 were expended during the past year compared with $185,792,000 in 1926. Capital expended for passenger train cars in 1927 totaled $53,769,000 compared with $58,117,000 the preceding year.

For shops and engine houses, including machinery and tools, reports showed capital expenditures amounting to $35,236,000 compared with $46,882,000 the year before while for all other improvements, $248,468,000 were expended, which was an increase of $7,649,000 over the corresponding period of the preceding year.

Great Britain Likes Special Purpose Tools

British machine tool production and exports remained practically the same during 1927 as during the two previous years. Imports to Sept. 30, increased 16 per cent, the American share of the total imports being 64 per cent, or the same as last year. American sales were largely in the way of special purpose tools such as millers, grinders, gear cutters, honers, and crankshaft and balancing machines.

The demand for coal mining machinery was better than in 1926 but owing to the continued unsettled conditions existing in the coal trade sales were about 15 per cent below normal years. American lines enjoyed fair sales, principally in chain coal-cutting machines. Little demand for other types of imported mining machinery was experienced. Prospects for coal-mining machinery are somewhat better for 1928.

Sales of road-making machinery declined heavily in all lines because of reduced grants for road maintenance. American concrete mixers and steam shovels enjoyed fair sales but the British demand is now supplied principally by domestic manufacturers, many using American patents on a royalty basis. Considerable sales improvement is expected in this line for 1928.

American textile machinery manufacturers continue to supply a substantial share of the knitting equipment imported by Great Britain. The home demand for textile machinery has been unsatisfactory. The demand from continental and far-eastern markets, however, has been good, adding greatly to trade.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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CONSIDERING the American business situation from a New York viewpoint, the stock market usually seems to be in the foreground of the picture. This is natural, for even Henry Ford does not get as much free advertising as is given to the Stock Exchange by almost every newspaper in the country. There is, however, some season to doubt whether the security markets exert the influence that is ascribed to them or are entitled to the space they occupy in the press. Certainly they have ceased to be precursors of the business trend, for while 1927 was a year in which stocks and bonds moved almost constantly upward, it was also a year of contraction in trade.

Since the beginning of 1928 and until last week there was a reversal of form in both business and the stock market, for the former showed a distinct improvement despite a substantial decline in the latter. But the anniversary of the President's inauguration, Saturday March 4, was seized upon by the Stock Exchange speculators for a *tour de force* whose objective seems to have been a revival of the upward movement in stocks under the leadership of General Motors, which made a spectacular advance as the result of speculative buying evidently planned to impress the public. A suspension of speculative activity on the Stock Exchange is moreover much to be desired for the sake of the commerce which ministers to the country's need of essential commodities, and a further advance in securities just now would make both bankers and merchants so careful that the distribution of merchandise would be slowed down all along the line.

There is indeed some evidence that the slowing down has already commenced. The steel industry is holding the gains recently made, but there has been no further increase in activity. Cotton textiles are quieter and raw cotton is a shade easier as the trade waits upon the two investigations now being held in Washington and the passage or defeat of the four bills for the reform of the cotton exchanges that have been introduced in Congress.

Rubber is about three cents lower on rumors that the British rubber producers were unalterably opposed to any further restriction of exports. Coffee and sugar are both higher. A Boston broker is credited or debited with a "squeeze" in March coffee and a New York firm is said to be behind a similar operation in March sugar. But as between the two commodities, there is this difference. There is a huge supply of coffee artificially held back in Brazil, whereas the production of Cuban sugar is so limited that there may be an actual deficiency by next autumn. Therefore it is not surprising that the trade is bearish on coffee and bullish on sugar.

WHAT'S DOING IN INDUSTRY

AFTER two brisk months in 1928, machine tool business may be said to be marking time according to reports received from most industrial centers. In some instances there has actually been a slight decline in trade, but this condition may be attributed to the fact that the last week in February was a good one. In those centers affected by automotive production, however, there has been a continued rise in market activity. Automobile production figures for February were the highest in a year and a half.

BECAUSE of this automotive production, employment in Detroit, Indianapolis and Milwaukee has shown a steady increase. Ford alone is employing close to 100,000 men. Cincinnati reports that unemployment conditions there have been greatly exaggerated by the local press, and in Cleveland few machinists are out of work. In Milwaukee, particularly, employment is better than at any time in 1927.

DESPITE the poor start in March, optimism is expressed everywhere that business will soon resume its previous activity. Many pending orders and quotations out make certain that March as a whole will not be a poor month.

RAILROADS have shown few signs of life in Philadelphia, Chicago and New York, although in the last instance it appears that at least one road is about to place some orders in the near future.

There has been no improvement in the badly disorganized coal industry and the oil companies are struggling with a production that is largely in excess of the demand. Outside of New York there seems to be less new building, and there is much unemployment in the larger cities, although the civic authorities have succeeded in providing jobs for many by starting work on public improvements ahead of time. Car loadings for the week ending Feb. 25 run 6 per cent under last year, but more than half the decrease was due to the reduced coal traffic.

These are what might be called the salients in the line of American business. At best it is a very irregular line, and it is hard to say whether it is being moved backward or forward. Certainly it was not much advanced last week, and a great deal depends upon the spring business in automobiles.

The motor trade has in fact become so important that it comes nearer to being barometric than almost any other industry, but its optimism and its publicity are so well organized that it is exceedingly difficult to tell whether it is going ahead or behind. Moreover it is so much in the public eye as a result of the hectic speculation in motor stocks that its ups and downs have a profound effect psychologically, and it is not too much to say that one would have a pretty good idea of how business would be for the rest of 1928 if he knew how many automobiles would be sold in the United States during the next nine months. For this reason the composite opinion of the country's automobile dealers would be invaluable if it could be secured, and it may be that the writer will attempt to obtain it.

Conditions abroad are still in contrast with those that prevail here. In parts of Russia there is an acute scarcity of food and several Chinese provinces the people are starving to death. In Western Europe things seem to be improving, but so many huge foreign loans are being floated here that some allowance should perhaps be made for European skill in propaganda and publicity. But there is at least no doubt that British trade is better and that France is now in a position to stabilize the franc, to which end she will shortly call back a substantial portion of the gold she has to her credit in London and New York. The one thing to be feared is that we may go too far or too fast in anticipating the return of the world's prosperity. If this can be avoided, no concern need be felt with regard to the future of business here or in Europe.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

BUFFALO

All phases of the machine tool trade and that having to do with electrical industrial equipment in Buffalo were rather dull during the first week of March, although February is generally conceded to have been a better month than January.

There were some signs however, that the later weeks of March would show an improvement although there seems to be more uncertainty in various quarters than has been the case for some time.

In the electrical field most orders are comparatively small, those for $10,000 being regarded as high. One machine tool dealer reported that February was the best month he had had in more than a year but added that this was without significance; many orders which had been hanging fire being closed in that month.

CINCINNATI

In the past week the machine tool industry of the Cincinnati district seems to have been, like all Gaul, "divided into three parts." That is, about one-third of the manufacturers reported a slight increase in sales in the period, about one third stated that they merely held their own and about one-third said that they had a slight falling off in business. Selling agents report that in the week there was practically no change in the situation in local territory, where there is a large volume of business pending, but which so far it has been impossible to close.

Several manufacturers report that in the past week there was an increased amount of buying by concerns in the automotive industry. A number of the orders received, it is stated, are of fair size and call for several tools, but the majority called for single tools, some for replacement purposes and others for try-out.

The backbone of the week's business, taking the trade as a whole, was the sale of single tools and replacements, the orders for which came from miscellaneous users and general machinists. The bookings were well diversified in the matters of types and sizes and the orders were well scattered over the country.

The majority of the manufacturers report that an increased number of inquiries were received during the week, the majority of which were for single tools and replacements, but an increased percentage of which called for two or more tools. The number and nature of the inquiries coming from the automotive field are regarded as being very encouraging. The consensus is that the trade pendulum has passed the lowest point and now is swinging upward.

CHICAGO

Business in machine tools for the first week in March has declined to a small extent, comparison being made with the last half of February. It is generally believed, however, that as the present month advances there will be a resumption of previous activity. There is at this time an unusual demand for special machinery, several orders having been booked for tools to be designed for specific uses.

Some disappointment has been experienced because of the failure of western railroads to come into the market with lists for equipment based on 1928 budgets, the Santa Fe being the only road to have thus far done so. There have been a few railroad inquiries for single tools and small lots, and an occasional order has been taken for heavy-duty tools, but there has been no intimation that railroad buying on a large scale is immediately contemplated.

Manufacturers of farm implements, builders of road machinery, and industrialists generally have furnished the bulk of the orders received recently. The International Harvester Co. will, it is reported, soon issue a list of requirements for its Fort Wayne, Ind., plant. The Nash Motors Co. continues to be a factor in the market, and is among those concerns that have placed orders for special machinery. The T. L. Smith Co. of Milwaukee, Wis., makers of concrete mixers, is reported to have about closed on lists totalling approximately $50,000. Dealers in used tools report trade as only fair, and inquiries have fallen off somewhat in volume.

PHILADELPHIA

A consistent upward turn in business was noted by the machinery and machine tool trade throughout the Philadelphia area during the last two weeks. A decided tendency toward buying was displayed from the automobile centers and from general industrial lines, this tendency having been shown in actual orders and in inquiries.

Dealers in metals used in the production of carbureters and automobile windshields reported some substantial orders from producers of that line of equipment. The orders also included sales of bevel gear cutters, abrasives, testing and measuring instruments, chain blocks and hoists, files, slotters, shapers and millers.

Producers of abrasives reported that January and February of this year were better than any two months of 1927, and most of the dealers and producers reported an increase in volume in February over the previous month. The orders came from a well scattered area. Dealers reported railroad buying inactive, with little prospect of heavy resumption in the immediate future.

NEW YORK

March has come like a lamb as far as the machine tool dealers in this district are concerned. Compared with the brisk business in January and February, the latter the better of the two, the past week's business would be classified as a temporary set-back, particularly since the last week in February was a very good one for several concerns. A spirit of optimism prevails, however, as in several lines the first ten days are generally considered slow. In addition, inquiries are plentiful except in those instances where business, even when good, must be "gone after." Industrial trucks fall in this category. One representative company handling this equipment reports considerable activity thus far in 1928 and looks forward to a good March.

Several firms in New Jersey not named have been buying machines and definite information is expected next week when most of the orders will be closed. Wright Aeronautical Co., of Paterson, is still purchasing a few new machine tools to close its list. The bulk of its purchases was second-hand equipment, however. As far as is known, no railroad orders have been received since part of the D. L. & W. R.R. list was placed last week. Rumors of big lists from the General Electric Co. sent a flock of salesmen to Schenectady, but they came back empty-handed. This company is usually considered a steady buyer, but has placed no large orders this year. Crane orders have been fair. The market for used and rebuilt machines has also been good for the last month.

Among the equipment sold from this territory in the past week are: two jig borers, three die sinkers, two engine lathes, several groups of turret lathes, five multicut lathes, some radial and upright drills, several presses, four hand millers, one universal miller and a surface grinder.

NEW ENGLAND

Orders placed in the New England section for machinery and machine tools, during the past week, were confined to single items. Business of this sort was quite brisk. A more pronounced forward trend has been harassed by a seeming reluctance to close on inquiries, outstanding since the first of the year.

During the week a Hartford builder booked orders for jig borer and die sinking machines. Bids are to be called shortly for a boys' club at Bristol, to include a machine shop. A Western Connecticut builders sold two lathes in Boston. The Connecticut Tool & Engineering Company, Bridgeport, bought rebuilt equipment. A St. Johnsbury, Vt., woodworking plant is said to be in the market for replacements.

The favorable tone of the market previously cited has not been over-emphasized. Conditions improve from week to week, and the presidential-year bug-a-boo, as a retarding industrial influence, is considered less and less a factor here.

CLEVELAND

No perceptible improvement in the market for machine tools in Cleveland was noted during the last two weeks. Orders continue to come in in a steady volume. Sales for February about equaled those of January; the first two months, however, exceeded those for a corresponding period in 1927. Gains in sales are noted in the automatic and punch press lines.

Inquiries are increasing in number. They include several lists, but the majority are in regard to one and two pieces. The Apex Electric Manufacturing Co. is inquiring for a number of tools for the manufacture of washing machines. The Ashtabula Bow Socket Co. has bought a few tools. Rubber tire manufacturers in the Akron district made recent purchases.

Production of machine tools is increasing steadily and is traceable to the accelerated production in the automobile industry. Virtually every skilled toolmaker in the city is employed. Producers in general are far ahead of their 1927 production schedules.

DETROIT

The machinery and machine tool business, while not keeping up the rapid advance that has marked its progress since the first of the year is however maintaining a high degree of steadiness and optimism.

The most outstanding thing of the week, however, is the fact that nearly all of the manufacturers of automobiles, and most of the associated industries have reported unusual prosperity for February. Almost without exception the automobile companies have reported higher sales for the past month than for any month within the past

year and a half and have announced plans for increased production to begin at once.

Most of the body builders are very busy. Employment is still rapidly increasing and there is a feeling of optimism that has not been exceeded here in many months.

Though the Ford Motor Company has not yet gone into big production it is employing more than 94,000 men in its Highland Park and Fordson plants.

Sales of machinery and tools have not been quite as numerous during the past week as they have been. Many good inquiries are coming in, however, and the orders that are being received are substantial and encouraging.

A great many of the small shops are exceedingly busy, although a few of them are idle. The makers of production tools are busy, but the makers of jigs and fixtures are not doing much. This situation indicates that most of the changes have been made and that the plants are concentrating now on production.

MILWAUKEE

Conservative expectations are being met in the volume of new business that is being booked by local manufacturers of metalworking equipment, and the situation, on the whole, may be described as showing steady improvement. The first half of March has produced a healthy degree of action on February and earlier inquiries, and the quantity of requests for prices and deliveries is being well maintained. With automobile factories approaching their heavy production season, there is considerable activity in getting production floors into shape, particularly as regards replacements.

Due to the improvement in the situation of metalworking shops, Milwaukee employment in March is not only higher than in this month last year, but it likewise exceeds the 1927 peak, reached in April. Forty-six representative shops had 36,111 on payrolls early this month, compared with 35,751 in March, 1927, and the peak, 35,942, last April. Applications for jobs are rather heavy, due largely to the movement of idle labor to Milwaukee from industrial centers less fortunate with respect to the activity that exists here because of the wide diversification of industry.

The favorable employment situation in foundries and machine shops is reflected by a relatively excellent call for new equipment from local industries, mainly the larger units. Some of the demand is for replacement, but requirements to meet heavier production needs are appearing with greater regularity, although the expansion is largely being accomplished without extensive additions to buildings.

Automotive Notes

The new body plant of the Graham-Paige Motors Corporation at Wayne, Michigan, has reached a production of 150 bodies a day and will soon reach 200. On Feb. 6 the first bodies were produced at this plant. Graham-Paige, through a subsidiary organization, has acquired the factory at Evansville, Ind., formerly used for the manufacture of truck bodies for the Graham Brothers. This plant will probably have a capacity of 30 bodies daily. The two plants will supply bodies for the 610 model, Graham-Paige. The 619 and 629 models will be supplied by the Briggs Manufacturing Co., as in the past.

A new series of six-cylinder "Red Seal" motors has been announced by the Continental Motors Corporation. The new motors, which were designed to provide speedier truck service, include five distinct models. Each model is independently built and each one is designed to give the best possible results for the particular displacement of that motor.

"The general public is eager to become better acquainted with the airplane," William B. Mayo, chief engineer of the Ford Motor Company, remarked in discussing plans for the American Aircraft Show to be held here during Aviation Week, April 14 to 21. A great many exhibits of motors and planes have been registered and it is expected that the business of designing and producing aircraft motors will be given a big impetus by the show.

A sectioned Wright Motor, produced by the Wright Aeronautical Corporation of Paterson, N. J., will be operated by electricity so that observers may study its inner workings in actual operation.

Personals

V. C. VOIGHT, formerly of the Pittsburgh offices of Briggs & Turivas, has joined the sales department of Erman, Howell & Co., Chicago, dealers in iron and steel scrap.

B. S. LIVINGSTON, vice-president of the Foreign Traders Co., 17 Battery Pl., New York, sailed recently on the "Columbus" for a short business trip to Germany, Belgium and Denmark.

W. W. GALBREATH, president of the Youngstown Pressed Steel Co., Youngstown, Ohio, has been named president of the Association of Pressed Steel Manufacturers, recently organized at Cleveland.

E. W. FULTON, has been named general manager of the Oswego Tool Co., Oswego, N. Y., taking over the duties of the late W. J. Henry, who formerly was general manager of the company.

CARL S. NEUMANN, secretary, Union Manufacturing Co., New Britain, Conn., maker of chucks, castings, etc., has been elected vice-president of the New England Foundrymen's Association.

D. F. GEISSINGER has been appointed direct factory representative by the Metal Saw & Machine Co., Inc., Springfield, Mass., for its western Pennsylvania territory with headquarters in the Oliver Building, Pittsburgh.

ARCHIBALD M. HALL, owner of the A. M. Hall Machine Co. of Indianapolis, and a former member of the state board of education, has announced his candidacy for the Republican nomination for representative in the Indianapolis district.

ROBERT E. CLINGAN, Toledo, Ohio, formerly sales manager of the Bock Ball Bearing Co., has been appointed assistant sales manager of the New Departure Co., Bristol, Conn., under Lester G. Sigourney, secretary and sales manager.

CHARLES E. STONE, vice-president of the Interstate Drop Forge Co., Milwaukee, manufacturer of drop forgings, has been elected president, succeeding C. R. Messinger, who is a member of the board of directors and president of the Chain Belt Co., of that city.

AMOS E. NORTHUP, custom designer of automobile bodies has been engaged as chief designer for the Willys-Overland Co., of Toledo. He will have charge of all designing of Whippet and Willys-Knight cars. This will include body styles, color designs, upholstery and decorative work.

HOWARD BRUCE, president of the Bartlett-Hayward Co., Baltimore, for eighteen years, has been elected chairman of the board of directors of that organization. He is succeeded as president by Howell Fisher, who has been first vice-president and general manager. Mr. Fisher has been with the company for 12 years. Albert C. Bruce has been elected vice-president.

F. E. BURGESS, secretary and assistant treasurer of the Burgess-Norton Manufacturing Co., Geneva, Ill., manufacturer of screw machine products, sheet metal stampings, automotive replacement parts and piston pins, has been elected vice-president and assistant treasurer of the company. C. M. Burges, president and treasurer, has been re-elected.

HAROLD STROUSE, advertising manager of the Harnischfeger Corporation, Milwaukee, manufacturer of electric traveling cranes, excavators, tools, etc., has been elected president of the Milwaukee Association of Industrial Advertisers. He fills the vacancy caused by the death of Howard Winton, general manager of branches of the Heil Co., Milwaukee.

NORMAN W. FOY, Boston sales manager for the Republic Iron & Steel Co., has been appointed its district sales manager at Birmingham. He succeeds E. M. Barnes, who becomes manager of pig-iron sales with headquarters in Birmingham. W. H. Oliver, in charge of the New York sales office, will continue his supervision of the Boston branch.

E. D. HILL, of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., will take charge of the company's new distributing office at 42 Church St., New Haven, Conn. Motors, pumps and Texrope drives will be three of the main lines carried. Sales will be under the direction of A. F. Rolf, manager of the Allis-Chalmers New York City office.

CHARLES E. BEARDSLEY, president of Beardsley & Wolcott Manufacturing Co., has been elected president and a director of the Bridgeport Brass Co., succeeding Carl F. Dietz. George T. Wigmore, Ralph E. Day, Paul D. Hamilton and Rowley Phillips replaced directors who had resigned. R. I. Reithercut, secretary, was succeeded by Mr. Wigmore, who also was elected treasurer. Walter Blatz, former general manager, has retired.

CHARLES A. BOULTMAN has been appointed manager of the supply department in the sales division of the Pangborn Corporation, Hagerstown, Md. He will have charge of the abrasive and supplies service for sand blast users. Mr. Boultman formerly was with the Carborundum Co., and the E. A. Kinsey Co., of Cincinnati. Grant Davis, formerly advertising manager of the Marion Steam Shovel Co., has joined the Panghorn Corporation as manager of its advertising division.

WILBUR C. OTIS has been transferred from the Quincy, Ill., plant of the Otis Elevator Co., to its Yonkers, N. Y. plant where he will be attached to the efficiency engineering department. Mr. Otis, who has been with the Quincy plant for the past 13 years is one of three veteran employees at Quincy to go to Yonkers. Warren Kincaid, foreman there for seventeen years, and John McKeen, department foreman for fifteen years also have gone to the Yonkers plant to spend three months.

Business Items

Letters of incorporation have been granted to The Dickson Co., 310 South Michigan Ave., Chicago. The company will manufacture and deal in machinery and mechanical equipment.

The Mid-West Die Casting Co., of Milwaukee, which filed papers of incorporation one year ago, now is in production of tools, dies and die castings, it is announced by G. R. Hinz, president.

The Norwalk Auto Parts Co., of Norwalk, Ohio, manufacturer of brake-testing equipment, has opened general sales offices in the Real Estate Trust Building, Philadelphia. I. L. Stayart is in charge as general sales manager.

The Kempsmith Manufacturing Co., of Milwaukee, Wis., manufacturers of milling machines and milling machine equipment, has established an export office in the Graybar Building, New York City. Paul H. Petersen will act as export manager.

The Tri-State Culvert Co., has announced the recent opening of a branch plant at Atlanta, Ga., and completion of a new building in that city for the immediate production of metal culverts. T. P. Cook has been appointed superintendent of the Atlanta factory.

The Foote-Burt Co., Cleveland, Ohio, elected the following officers at its annual meeting: G. E. Randles, president; S. E. Gross, secretary and treasurer. Directors: G. E. Randles, S. E. Gross, T. H. Doan, Jr., Paul J. Bickel, C. H. Burke.

The Gerrard Co., of Chicago, manufacturer of wire binding machinery, has moved its Southern distributing office from Atlanta, Ga., to New Orleans, La., where an office and warehouse has been opened at 200 South St. Peters St. H. B. Hand, Southern representative, is in charge.

Hill & Foster, Inc., is a new concern recently formed at Wichita Falls, Tex., to establish a plant for the manufacture of automatic cat heads for oil drilling machines. W. W. Foster, 1612 Monroe St., and Gordon T. West, 1411 Grant St., (both Wichita Falls), are among the incorporators named.

The Carpenter Steel Co. of Chicago, has announced the occupancy of its new Chicago district warehouse at 1516 Carroll Ave. This building is equipped with such modern appliances as are necessary for the prompt and efficient handling of the large assorted stock of tool and alloy steels distributed from this point.

The United States Electrical Tool Co., Cincinnati, has opened a new branch office in Syracuse, N. Y., in charge of H. N. Kelsey, whose territory will include the greater part of New York State. Mr. Kelsey formerly was connected with the Syracuse Twist Drill Co., and previously with the Waltham Grinding Wheel Co., of Waltham, Mass.

The Gough Aircraft Co., of Oklahoma City, Okla., has announced that it soon will be in production on a 250-hp. engine, which is said to have an extremely low weight per horsepower. The company recently was incorporated in Oklahoma City by Frank Gough, Sherman Foster and Bob Rutherford, all of that city. Patents now are pending and it is understood that a factory will be built near the Tibbs Flying School.

The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., announces the appointment of R. T. Stafford, formerly district manager of the Seattle office, as assistant manager of the electrical department in charge of sales and engineering at the Pittsburgh Transformer Works. John Alberts of the Seattle office has been appointed district manager, succeeding Mr. Stafford. The Seattle district embraces the states of Washington and Oregon. A branch office is located at Portland.

The Eastern Rolling Mill Co., Baltimore, has declared its regular quarterly dividend of 37½ cents a share on common stock. No action was taken on the usual extra dividend of 12½ cents a share. It was explained, however, that this was not due to insufficient earnings but to a change of policy under which the board of directors will declare, in the future, such extra dividends as may be justified by earnings. This action will be taken annually at the close of the fiscal year instead of quarterly, as has been the case heretofore.

The Shaw Crane-Putnam Machine Co., Inc., of Fitchburg, Mass., owned by Manning, Maxwell & Moore, Inc., New York, announces the purchase of the Lamb & Nash line of sheet metal machines. Included in the Lamb & Nash line are the rotary gang slitting machines for shearing tin plate, hot mill sheets, blue annealed, brass, copper, aluminum, and all classes of cold-rolled steels. Lamb & Nash squaring sheer also is included. All future manufacture of machines of the Lamb & Nash line will be carried on at the Fitchburg, Mass., factory.

Obituaries

ARTHUR WARD FOX, vice-president and general manager of the Billings & Spencer Co., of Hartford, Conn., manufacturer of tools, died recently at his home in that city. Mr. Fox was for 21 years affiliated with the Johns-Pratt Co., of Hartford, advancing from clerk to vice-president and general manager. In 1924 he resigned to take over similar duties with the Billings & Spencer Company.

JONATHAN DIXON MAXWELL, pioneer automobile manufacturer, died recently at his home in Worton, Md., in his 64th year. He was one of the three men who built the machine, now preserved in the Smithsonian Institution, and believed to have been the first automobile. Mr. Maxwell, whose name was given to the Maxwell automobile, was, before his interest in automobiles, a partner in a small bicycle repair shop in Kokomo, Ind., his birthplace.

CHARLES P. HOWARD, president of James L. Howard & Co., Inc., Hartford, Conn., manufacturers of railway car supplies, died March 6 at his home, 116 Farmington Ave., that city. Mr. Howard was born in Hartford in 1853, and was graduated from the Massachusetts Institute of Technology. He was a member of the American Society of Mechanical Engineers and his business career was entirely spent with the James L. Howard company.

Calendar of Local Meetings

National Association of Cost Accountants

Baltimore Chapter. April 17. Subject: "The Budget in Manufacturing—Application of Budgetary Principles and Their Performance."

Boston Chapter. April 26. Subject: "Cost and General Accounting Procedure for a Paper Mill," by Homer A. Sargent.

Buffalo Chapter. April 26. Hotel Buffalo. Subject: "Debatable Questions in Industrial Accounting." By Clarence S. Marsh.

Cincinnati Chapter. April 17. Subject: "Accounting for Value of Fixed Assets," by H. G. Baldwin.

Chicago Chapter. April 19. Subject: "What the Sales Department Wants From the Accountant," by V. Frank Banta.

Society of Automotive Engineers

Cleveland Chapter. March 12. Subject: "The Importance of Mechanical Inventions," by F. O. Richey.

Pennsylvania Chapter. March 13. Subject: "Alloy Steels as Applied to the Automotive Industry," by Dr. B. Egeberg.

American Society of Mechanical Engineers

Metropolitan Section. March 28. Subject: "Design and Building of Jigs and Fixtures," by F. P. Hutchinson, Western Electric Co., and Harry Pound, International Motor Company.

Toledo Section. March 22. Subject: "Steel as Specified and Tested for Use in Airplanes," by J. L. McCloud.

Detroit Section. June 27 and 28. The Aeronautic Division has accepted an invitation to hold its convention in Detroit on the above dates.

Cleveland Section. April 2. Subject: "Progress and Status of Engineering Standardization," by George T. Trundle.

National Association of Foremen

Canton Section. May 25 and 26. Subject: "The Foreman as an Executive," by E. H. Tingley.

Forthcoming Meetings

Southern Supply & Machinery Dealers' Association. Will meet in annual convention in Nashville, Tenn., May 15, 16 and 17 jointly with the **National Supply & Distributors' Association** and the **American Supply & Machinery Manufacturers' Association.**

National Safety Council. Mid-West Safety Conference, Chicago, March 19. A. A. Mowbray, director of publicity, 108 E. Ohio St., Chicago.

American Gear Manufacturers' Association. Twelfth annual meeting, Rochester, N. Y., April 19, 20 and 21, Hotel Seneca. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Welding Society. Annual meeting, week of April 23, New York City. M. M. Kelly, secretary, 33 West 39th Street, New York City.

American Railway Association. Schedule of sectional meetings: Division IV, Engineering, March 6 to 8, Chicago; Division V, Mechanical, June 13 to 20, Atlantic City, N. J.; Division VI, Purchases and Stores, June 13 to 15, Atlantic City, N. J. Division VI, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

National Metal Trades Association. Thirtieth annual meeting, Hotel Astor, New York, April 25 and 26. J. E. Nyham, secretary, Peoples Gas Bldg., Chicago, Ill.

National Foreign Trade Council. Fifteenth anniversary convention, Houston, Texas, April 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

American Society of Mechanical Engineers. Spring Meeting, May 14-16, Pittsburgh, Pa. Calvin W. Rice, secretary, 39 West 39th St., New York City.

American Foundrymen's Association. Convention and Exhibit, Philadelphia, May 14 to 18. Technical Sessions at Hotel Belleview-Stratford; exhibit at Commercial Museum. R. E. Kennedy, secretary, 140 So. Dearborn St., Chicago.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

STEEL price advance of two weeks ago is meeting with resistance from buyers who had filled requirements for the current quarter at the old price of $1.85 per 100 lb., Pittsburgh. Present quotation of $1.90 is practically nominal but shows no tendency to recede. Steel production was slower in the first week of March. February ingot output, however, gained 3 per cent over January. Steel mills continue to operate at the comparatively high rate of 80 to 90 per cent of capacity. Bars lead in current buying, followed by fair demand for sheets, shapes and rails. Orders for tie plates and track materials, on the other hand, have slowed down considerably during the last week. Non-ferrous metals tend downward with this week's declines principally in solder, babbitt metal and scrap. Wiping cloths are off about 2c. per lb. at New York.

(All prices as of March 9)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.50	3.25	3.89
No. 12	2.15@2.25	3.55	3.30	3.94
No. 14	2.20@2.30	3.60	3.35	3.99
No. 16	2.30@2.40	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.55	4.00
No. 22	2.85@2.95	3.90	3.70	4.15
No. 24	2.90@3.00	3.95	3.75	4.20
No. 26	3.00@3.10	4.05	3.85	4.30
No. 28	3.15@3.35	4.20	4.00	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.90	4.25
Nos. 12 to 14	3.05@3.15	4.20	4.00	4.35
No. 16	3.15@3.25	4.30	4.10	4.45
No. 18	3.30@3.40	4.45	4.25	4.60
No. 20	3.45@3.55	4.60	4.45	4.75
No. 22	3.50@3.60	4.65	4.50	4.80
No. 24	3.65@3.75	4.80	4.60	4.95
No. 26	3.90@4.00	5.05	4.85	5.20
No. 28	4.15@4.25	5.30	5.10	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard, sizes 36–5% off.

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness Decimal	Thickness B.w.g. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	¾	1	1¼	1½
		Price per Foot							
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049″	18	.17	.18	.19	.20	.21	.23	.25	
.065″	16	.19	.20	.21	.22	.23	.25	.27	
.083″	14	.20	.22	.23	.24	.25	.27	.29	
.095″	13	.21	.23	.25	.26	.27	.29	.31	
.109″	12	.22	.24	.26	.27	.28	.30	.32	
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33	
.134″	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	....	4.65
Spring steel, heavier	4.00	....	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	5.70	6.10
Floor plates	5.25	5.30	5.00
Cold drawn, round and hex	3.40	3.65	3.60
Cold drawn, flats and squares	3.90	4.15	4.10
Structural shapes	3.34	3.00	3.10
Soft steel bars	3.24	3.00	3.00
Soft steel bar shapes	3.24	3.00	3.00
Soft steel bands	3.99	3.65	3.65
Tank plates	3.34	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½ 7.35c. per lb. *Flat, 3/16@½-in. thick.

METALS

Current Warehouse Prices in Cents Per Pound for Small Lots.			
Copper, electrolytic, up to carlots, New York			15.37½
Tin, pigs, 5-ton lots, New York			53.25
Lead, pigs, up to carlots, E. St. Louis 5.80	New York		6.62½
Zinc, slabs, up to carlots, E. St. Louis 5.52½	New York		6.50

	New York	Cleveland	Chicago
Antimony, slabs, ton spot	12.75–13.25	13.25	14.25
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	19.37½	19.37½	16@16½*
Copper bars, base	22.25	22.25	22.25
Copper tubing, base	24.50	24.50	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

*Mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%*	24.30	22¾@24	24.03
Zinc sheets (casks)	10@10½	12.65	10.36
Solder (½ and ½), (case lots)	33.25	32.50	33@37
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			69.00
Commercial genuine, intermediate grade			57.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot 36.00	

*F.o.b. producing point.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	12.25 @12.50	11.50	11.00@11.50
Copper, heavy, and wire	11.50 @12.25	10.75	10.50@11.00
Copper, light, and bottoms	10.25 @10.75	9.50	9.25@ 9.75
Heavy lead	4.62½@ 4.87½	5.25	4.50@ 5.00
Tea lead	3.50 @ 3.75	3.75	3.50@ 4.00
Brass, heavy, yellow	7.00 @ 7.25	7.25	7.00@ 7.50
Brass, heavy, red	9.00 @ 9.50	9.75	9.00@ 9.25
Brass, light	5.50 @ 5.75	5.75	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.10	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@.17
Wiping cloths, washed white, per lb	.15@.17	38.00 per M	.15
Sal soda, per lb	.02	.02	.02¾
Roll sulphur, per lb	.027	.03½	04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.76½	.84	.78
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.50	.50
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.27	.36	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade	45%	50–10%	50%*
Second grade	50%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60–10%.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.034	.033	.04
Brass rods	per lb.	.165	.165	.161½
Solder (½ and ½)	per lb.	.3325	.3425	.425
Cotton waste, white	per lb.	.10@ 13½	.10@.13½	.13@.17½
Emery disks, cloth, No. 1, 6-in. dia	per 100	3.10	3.10	3.10
Lard cutting oil	per gal.	.65	.65	.55
Machine oil	per gal.	.27	.27	.33
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	40%

*New list April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.40	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
*Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.65@3.00		
Coke, prompt foundry, per net ton	Connellsville, 3.75@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.75	
Red lead, dry	100 lb. kegs	New York, 13.75	
Red lead, in oil	100 lb. kegs	New York, 15.25	

*4½ reams and under.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1¼ and 1½ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ⅞-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Conn., New Haven—Bd. of Education—wood working and machine tool equipment for proposed 1 story, 100 x 100 ft. training school to have industrial shop and woodworking department. Estimated cost $100,000.

Md., Baltimore—Virginia Barrel Co., Leadenhall and Ostend Sts.—machinery and equipment for the manufacture of steel drums for proposed addition to plan.

Mich., Adrian—Kewaunee Mfg. Co.—machinery and equipment for the manufacture of laboratory furnishings and furniture for proposed 2 story, 50 x 100 ft. factory. Estimated cost $50,000.

Mich., Detroit—Bower Roller Bearing Co., 3040 Hart Ave.—machine shop equipment including grinder, etc.

Mich., Detroit—Chevrolet Motor Car Co., Holbrook Ave.—general machinery and assembly equipment for proposed 1 story, 400 x 800 ft. addition to gear and axle plant.

Mich., Detroit—Electric Sprayit Co., 217 Iron St.—No. 2 Bardons & Oliver turret lathe with turret feed, No. 2 Warner & Swasey turret lathe with turret feed, quick change lathe with collets, 12 x 14 in. and ball bearing 2 spindle Allen drill press.

Mich., Detroit—E. H. Kotcher Die & Tool Co., 1742 Rivard St.—shaper and equipment.

N. J., Bayonne—Gulf Refining Co., Frick Annex Bldg., Pittsburgh, Pa.—one ½ ton, 18 ft. span underhung hand power crane for plant here.

O., Greenfield—Gray-Elliott Mfg. Co., W. A. Gray, Pres. (furniture and wood products) wood working equipment for plant to replace fire loss.

Tex., Mercedes—Roman & Talbert—miscellaneous tools and equipment for proposed machine shop and garage. Estimated cost $50,000.

Wis., Milwaukee—American Metal Products Co., 1348 Burnham St.—receiving bids for a traveling crane for proposed 1 story, 80 x 100 ft. addition to foundry.

Opportunities for Future Business

Calif., Vallejo—McDonald & Harrington, 16 California St., San Francisco, plans the construction of a planing mill here. Estimated cost $40,000.

Conn., Stamford—E. M. Jennings, 27 Harrison St., Bridgeport, plans the construction of a garage at Main and South Sts. Estimated cost $100,000. Architect not selected.

Ga., Atlanta—C. F. Palmer, Palmer Bldg., is having plans prepared for a 5 story, 88 x 113 ft. garage and office at Spring and Marietta Sts. Estimated cost $300,000.

Ill., Chicago—J. Chutkan, 10 South La Salle St., awarded contract for a 100 x 235 ft. garage at 4941 Broadway Ave. Estimated cost $50,000.

Ind., Bloomington—Showers Brothers Co., manufacturers of furniture, awarded contract for five dry kilns, 78 x 101 ft. Estimated cost $52,000.

Ia., Ames—Fort Dodge, Des Moines & Southern Transportation Co., awarded contract for a 1 story, 30 x 108 ft. service garage.

Ia., Fort Dodge—John M. Schaupp, Jr., will build a 1 story, 106 x 140 ft. repair and service garage at First Ave. and Fifth St. Estimated cost $40,000. Rankin Motor Co., 1104 Central Ave., lessee.

Md., Baltimore—Bd. of Awards, awarded contract for a 3 story, repair shop and warehouse at 20th and Curtain Sts. Estimated cost $127,340. Noted Jan. 12.

Md., Baltimore—Wilson-Nash Motors Co., 29th and Remington Ave., awarded contract for a 1 story sales and service station. Estimated cost $75,000. Noted Oct. 27.

Mass., Beverly—Weiner Bros., 92 Bridge St., Salem, is receiving bids for a 1 story, 55 x 85 ft. repair and service garage on Rantoul St. here. Estimated cost $40,000. Private plans.

Mass., Boston—S. B. Wellett, 1 Nassau St., awarded contract for a 3 story, 25 x 50 ft. shop at 1-3 Nassau St.

Mass., Boston—H. Goldman, 377 Harrison Ave., will build a 2 story, 45 x 80 ft. repair and service garage at 34-46 Troy St. Estimated cost $40,000. A. J. Carpenter, 1 Moss Hill Rd., Jamaica Plain, Archt.

Mass., Chelsea (Boston P. O.)—B. Krakofsky, 460 Webster Ave., awarded contract for a 1 story repair and service garage on Pearl St. Estimated cost $40,000.

Mass., Fall River—Noyes Buick Co., 857 Commonwealth Ave., Boston, will build a 1 story, 150 x 150 ft. repair shop and service station at Durfee and Cherry Sts. F. A. MacShaffrey, c/o owner, Archt.

Mass., Framingham—Butler Motor Corp., 46 Kendall St., is receiving bids for a 1 story, 60 x 100 ft. addition to repair and service garage on Kendall St. Estimated cost $40,000. E. R. Haberstroch, 102 Irving St., Archt.

Mass., Melrose (Boston P. O.)—S. S. Porter, 462 Main St., will build a 1 story auto repair shop at 391-401 Main St. Estimated cost $40,000. Private plans.

Mass., Salem—Townsend Motor Car Co., Derby St., will soon award contract for a 1 story, 70 x 210 ft. garage. Estimated cost to exceed $40,000. G. H. Fanning, 221 Essex St., Archt.

Mass., South Boston (Boston P. O.)—Simon Box Co., 61 Wareham St., Boston, is receiving bids for a 1 story, 100 x 128 and 50 x 100 ft. factory on East First St. Estimated cost $75,000. Eisenberg & Feer, 46 Cornhill St., Boston, Archts.

Mass., Watertown (Boston P.O.)—Peerless Pressed Metal Co., 14 Electric Ave., Brighton, is having plans prepared for a 1 story, 80 x 200 ft. factory here. Estimated cost $40,000. Private plans.

Mich., Detroit—Book Estate, Book Bldg., awarded contract for a 12 story, 100 x 182 ft. garage on Washington Blvd. Noted Dec. 15.

Mich., Detroit—Chevrolet Motor Car Co., 1840 Holbrook Ave., awarded contract for a 1 and f story, 80 x 400 ft. forge shop on Holbrook Ave.

Mich., Detroit—Wise Chrome Products Co., 2474 Bellevue Ave., manufacturers of metal products, plans a 1 and 2 story, 72 x 133 ft. factory. Estimated cost $50,000. A. F. Herman, Owen Bldg., Archt.

Mich., Highland Park (Detroit P. O.)—Chrysler Motor Car Co., 341 Massachusetts Ave., awarded contract for a 1 and 2 story, 83 x 580 ft. body receiving and storage building.

Mich., Ironwood—William Meade & Son, plans a 1 story, 40 x 140 ft. garage and repair shop on McLeod Ave. Estimated cost $35,000.

Mich., Niles—Kompass & Stoll Co., awarded contract for a 2 story, 60 x 100 ft. factory for the manufacture of kitchen cabinets. Estimated cost $50,000. Private plans.

Minn., Minneapolis—The Dayton Co., 7th St. and Nicollet Ave., will receive bids until Mar. 16 for a 4 story addition to garage. Estimated cost $500,000. Long & Thorshov, 1028 Andrus Bldg. and Larson & McLaren, 308 Baker Bldg., are associate architects.

Minn., Minneapolis—Hayden Motor Co., 1301 West Lake St., awarded contract for a 1 story, 128 x 138 ft. garage at 1221 West Lake St. Estimated cost $40,000.

Mo., Kansas City—Capital Garage Inc., H. Rubin, Pres., plans the construction of a 7 story, 123 x 180 ft. garage. Estimated cost $150,000. Private plans.

N. J., Perth Amboy—American Smelting & Refining Co., Maurer St., will build a 78 x 432 ft. plant on State St. Estimated cost $63,000. Private plans.

N. Y., Mount Vernon—J. Holt, 231 West Lincoln Ave., awarded contract for a garage, etc. Estimated cost $60,000.

N. Y., New York—Packard Motor Car Co. of New York, L. J. Eastman, Pres., had plans prepared for a 14 story 216 x 225 ft. auto repair shop at 773 11th Ave. Estimated cost $500,000. F. S. Parker, 119 West 57th St., Archt.

N. Y., Rochester—Rochester Auto Inns, is having plans prepared for a 5 story, 115 x 152 ft. garage. Estimated cost $200,000. R. O. Derrick, 120 Madison Ave., Detroit, Mich., Archt.

N. Y., Rochester — Shoen Bros., 68 Genesee St., will soon award contract for a 2 story garage at 408 Brown St. Estimated cost $50,000. Foote & Carpenter, 14 Franklin St., Archts. Noted Dec. 22.

O., Akron—Arcade Garage Co., S. Morgenroth, Pres., awarded contract for a 4 story, 132 x 132 ft. garage. Estimated cost $300,000. Noted Jan. 12.

O., Canton—Hercules Motor Corp., manufacturers of internal combustion engines, plans to rebuild a 1 story, 75 x 125 ft. factory at Halliwell Pl. S.E. recently destroyed by fire. Estimated cost $50,000.

O., Cincinnati—Sycamore Garage Co., 2400 Gilbert Ave., awarded contract for a 4 story garage on Sycamore St. Estimated cost $300,000. Noted Feb. 23.

O., Springfield — The International Harvester Co., W. D. Price, Const. Mgr., 606 South Michigan Ave., Chicago, Ill., awarded contract for a 1 story, 100 x 158 ft. service building here. Estimated cost $150,000.

Pa., Ford City—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, will build a 1 story, 110 x 115 ft. addition to machine shop. Estimated cost $40,000.

Pa., Philadelphia — Goldfine Bros., 350 North Second St., will soon award contract for a 2 story, 72 x 200 and 45 x 64 ft. garage at 342-44 North Second St. D. Supowitz, 929 Chestnut St., Archt.

Pa., Philadelphia — Philadelphia Rapid Transit Co., Broad and Walnut Sts., plans the construction of a garage at Broad and Olney Sts., also one at Locust and Broad Sts. Estimated cost $1,500,000 and $2,000,000 respectively. Private plans.

Pa., Pittsburgh—B. H. Prack, Martin Bldg., Archt., will receive bids about Mar. 13 for a 1 story addition to plant for the manufacture of gas burners and water heaters for Lawson Mfg. Co., 300 Lexington Ave. Estimated cost $50,000.

Tex., Harlingen—J. C. Silvers, Dallas, plans the construction of a box and crate factory here.

Wis., Milwaukee—Muller Investment Co., M. & M. Bldg., is having plans prepared for a 3 story, 100 x 150 ft. garage and office at 4th and Cedar Sts. M. Tullgren & Sons Co., 9 Waverly Pl., Archts.

Ont., Fergus—Beatty Bros. Ltd., awarded contract for a 1 story, 200 x 200, 100 x 100, 72 x 96 and 48 x 75 ft. additions to factory for the manufacture of farm implements. Estimated cost $150,000.

Ont., Hamilton—General Motors Ltd., awarded contract for a garage on Main St., also plans a 1 story, 62 x 242 ft. garage on Bond St. Oshawa. Estimated cost $350,000 and $60,000 respectively. Hurton & Souter, Hamilton, Archts.

Ont., Toronto — Canadian Wirebound Boxes Ltd, 1000 Gerrard St. E., plans the construction of a 1 story factory and warehouse. Estimated cost $150,000. Architect not selected.

Ont., Toronto—W. E. Dillon & Co., Ltd., 189 George St., (sheet metal workers) plans a 2 story, 15 x 35 ft. addition to plant.